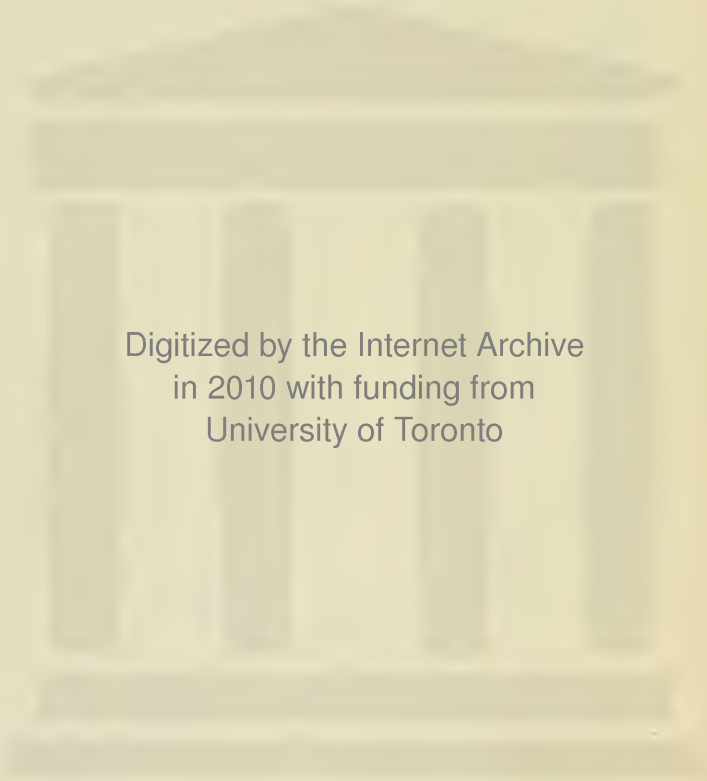

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University of Toronto

MEDICAL BULLETIN

PUBLISHED BY THE FACULTY OF MEDICINE

VOL. I, NO. 1 MARCH, 1921

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SPECIAL GRADUATE COURSES

The Faculty of Medicine announces the following Special Graduate Courses which will be given from May 23rd to 28th, 1921. The fee for courses 1, 2 and 3 will be $10.00 each, payable on registration. The courses run concurrently and it will therefore be impossible for a candidate to take more than one course. As the courses are limited, applications will be dealt with in the order of their receipt by the Secretary of the Faculty of Medicine, up to May 7th, 1921.

1.—*Combined Course in Medicine and Surgery.*

Six hours a day for a week will be devoted to these subjects.

In *Medicine* a choice is given of

(*a*) Neurology (20 students).

(*b*) Diseases of the Cardio-vascular system (20 students).

In *Surgery*, the subject of Fractures will be covered, stress being laid on modern methods of treatment (40 students).

2.—*Obstetrics and Gynaecology* (10 students).

Six hours a day for a week will be devoted to instruction.

(*a*) *Clinical Obstetrics*, including pre-natal work, pelvimetry and the conduct of labour.

(*b*) *Clinical Gynaecology*, including diagnosis and non-operative treatment.

3.—*Ophthalmology and Oto-Laryngology* (6 students).

Six hours a day for a week will be devoted to these subjects.

(*a*) *Ophthalmology*, including the use of the ophthalmoscope and retinoscope, squint and glaucoma.

(*b*) *Oto-Laryngology*, including the examination of the ear, nose and throat for the general practitioner.

A special course in *Paediatrics* (20 students) will be given from July 4th to 30th (fee $20.00). Applications will be received up to June 12th, 1921.

EDITORIAL

THE Faculty of Medicine is undertaking to fulfil its duty to the profession in the Province as a state institution in a number of ways. It is seriously handicapped in this endeavour by being over-burdened by a large number of undergraduates, there being more students in the last three years than in all the years of any other first class medical school on this continent. In spite of this fact, the Faculty provides facilities to practitioners to enable them to keep abreast of the progress being made in the various branches of medicine either (1) by attending undergraduate courses by the week or month, or (2) by extension lectures, or (3) by short "refresher" courses in the holidays. Ten or fifteen practitioners avail themselves of the first method every year; over fifty extension lectures have been delivered before some twenty local Medical Societies; and the Special Graduate Course last Christmas was attended by fifty medical men.

As many cannot avail themselves of these advantages, this publication is being issued by the Faculty to every practitioner in the Province, calling their attention to the subjects and dates of refresher courses and containing short pithy articles on recent advances of medicine, written especially for the practitioner.

The necessity of the practitioner definitely urging his patients to breast-feed their babies is emphasized in the first article, while in the second, a typical history of a case of Auricular Fibrillation, showing the results of rational treatment, is described.

Attention is drawn to the three Graduate Courses to be held at the end of May of this year, for which application should be made at once as the number admitted to each course must necessarily be limited. The clinics given at these courses are specially prepared to aid the practitioner in both diagnosis and treatment.

Members of the profession are urged to consult the list of Extension Lectures issued by the Ontario Medical Association, of which about 100 are contributed by the Faculty of Medicine, for the purpose of asking their local Medical Society to avail themselves of this opportunity of keeping in touch with recent medical advances.

The Faculty are anxious to meet the needs of the practising doctor and would therefore appreciate any suggestions that can be made whereby the University can assist him in his every day work.

THE SECRETION OF MILK

V. E. HENDERSON, M.A., M.B.

(*Department of Pharmacology*)

The mammary glands are in their origin skin glands, but are very highly developed and specialized. They differ from the other skin glands very greatly in their nervous control. The sweat glands receive an abundant secretory nerve supply from the ganglionated chain of the sympathetic and stimulation of their nerves either with the electric current or with such drugs as pilocarpine leads to an abundant secretion. Physiologists and pharmacologists have searched in vain in animals and man for any such nerve supply to the mammae. Yet most physicians are aware that when the child is put to the breast the mother may experience a peculiar sense of sudden fullness, and even in some cases will see a spurt of milk from the other nipple. This reaction is not as yet clearly explained, but is probably a reflex muscular contraction. Attempts to increase the secretion of milk have been made with all types of drugs, but as yet absolutely without effect, and it is very improbable that a drug will be discovered which will increase the daily yield. Further, the experiments of Goltz, Eckhardt, and others, show clearly that the gland can function normally even if deprived of its nerve supply.

Physicians, however, know that worry and anxiety often cause a decline in the milk secretion and Mironow showed by experiments on goats that frequent pains would decrease the secretion. This decrease is, however, almost certainly an indirect one due to decreased consumption of food.

For the growth of the mammary glands during pregnancy, functioning ovaries seem to be necessary (in lactation in man, the testes probably play the same part), but after lactation is established the ovaries are no longer required, but may be removed without interrupting the milk flow. Starling and Claypon caused a development of the mammae by injecting virgin rabbits with foetal extracts. But as virgin women have suckled young and Hill found a virgin kid secreting milk and obtained four ounces at one milking, and in various other milkings during the next three months a total quantity of two quarts, neither foetus, nor placenta, nor a corpus luetum is essential. We have indeed not found any internal secretion or gland product which is responsible for the production and flow of milk. Here again most possible theories seem to have been tried, and all, on careful analysis, have proved valueless.

A great deal has been made of the interesting observations of Schaeffer that the injection of an extract of the pituitary gland causes an increase in the secretion of milk. This is undoubtedly true, but the effect is very temporary and evanescent. Such an injection will not increase the daily total nor will repeated injections do so. Precisely how this action is produced we do not know, but we are sure that it has no therapeutic value. The extracts of various other glands produce similar but weaker effects. We know of no hormone or glandular product which will increase the milk supply.

The numerous and careful studies made on man and animals show the importance of the act of suckling to produce and maintain the flow of milk. The child must suckle, it must be stirred up to suckle, and kept at work. The weak baby, sleepy and depressed, with an ill developed suckling reflex, must be kept at work and must empty the gland if a good flow of milk is to be obtained. This the mother often does not know and too often the physician neglects to instruct her. There seems little doubt that this neglect on the part of mother and physician accounts for many a failure. Each physician knows well that if the child be weaned the milk supply dries up. If the milk is retained in the gland it fails to secrete. Often a mother feeds from one breast at each feeding only. The feedings are at four hour intervals. This means each breast is emptied once in eight hours, or if, as is usual, there is no feeding from 10 p.m. till 6 a.m., one breast is not used for twelve hours. The milk supply will often improve if both breasts be used at each feeding. Emptying the breast is very important in sustaining the flow.

The most important factor in maintaining an adequate secretion of milk is, however, to be found in the mother's diet. To produce a satisfactory amount of milk, the mother must be adequately supplied with food.

The protein or meaty foods are all important. If the milk is lacking in richness or amount these foods must be increased to improve it. Increasing the fats alone may temporarily increase the fat of the milk and even its amount, but the improvement will not last. The effect of increasing the carbo-hydrates, sugars and starches, is even less. The lactose of the milk, even if the general nutrition be bad, is rarely below normal in amount. Increased consumption of food may be obtained by a tonic and in this way alone can drugs aid the physician. A greater variety of food, more palatable cooking and serving will often help greatly. Even under the best conditions there is often, after the first month, monthly variations in output, even before the menses recur. See that your patient does not worry over this, nor start bottle feeding unnecessarily. More food, more appetite, and more rest will usually suffice to maintain the secretion.

AURICULAR FIBRILLATION

ROSS A. JAMIESON, B.A., M.B.

(*Department of Medicine*)

The patient was an English gardener, forty-seven years of age, admitted 21/11 1920. His complaint was shortness of breath, and swelling of the feet, legs, and abdomen. These symptoms had been present for one week prior to admission. His habits were regular, used tobacco and alcohol in moderation, no history of rheumatism or any acute infection.

Until June, 1920, he was quite well. He was then doing additional work, preparatory to moving to Canada, when, without any premonitary symptoms, he was taken suddenly ill with shortness of breath and several days later noticed swelling of his feet, legs, abdomen, and face. He went into a hospital in England and remained there for three months, being confined to bed for the greater portion of that time On his discharge all symptoms had disappeared and he felt quite well. Five weeks before present admission to hospital he came to Canada, and immediately secured work as a gardener. For several weeks he carried on without difficulty. One week before admission, following some rather heavier work than usual, he was again taken suddenly ill with shortness of breath. After a short rest he was able to continue light work for several days; but the symptoms becoming progressively more acute and swelling of the feet and ankles appearing, he came into the hospital.

Examination.—The patient was well nourished, of normal development, air hunger marked, and he was unable to lie down in bed; cynosis very evident. There was also considerable engorgement of the vessels in the neck.

The area of cardiac dullness was increased both to the right and to the left; most markedly beyond the area normally occupied by the left auricle. No abnormal pulsations were visible over the precordium. The apical impulse was felt with difficulty. No thrills were palpable. On auscultation, the most striking features were the rapid ventricular rate and complete irregularity of the heart's action; no two successive beats appearing to be equidistant, nor to be of equal intensity and force. The rate, as counted at the apex, was one hundred and forty beats to the minute, but at the wrist only one hundred and twenty. In the radial pulse the important features were the irregularity in rhythm and force of successive beats.

At all areas over the precordium the heart sounds were distant and gave the impression of poor muscular quality. At the apex the first sound was slightly accentuated, and followed by a distant blowing murmur, which was also audible in the axilla. The second sound at the apex was impure and followed by a faint short rumbling murmur. At the base over the pulmonic area the second sound was accentuated.

Examination of the respiratory system showed limited excursion of both lungs. There was diminished resonance and fremitus, with altered breathing and voice and many fine moist rales at the bases of both lungs posteriorly. The abdomen was moderately distended. A small area of shifting dullness could be made out in the flanks. The liver edge was palpable three inches below the costal border and there was definite tenderness over this area. The urine had a specific gravity of 1026, moderately heavy trace of albumen, few white blood cells, and many hyaline casts.

A diagnosis of auricular fibrillation was made and this was substantiated by polygraphic and electro-cardiographic curves, both of which demonstrated the absolute irregularity of ventricular action with complete absence of evidence of any completed auricular contraction.

The Concentrated Tincture of Digitalis of Burroughs, Wellcome Co. was administered, which, as standardized, was shown to be three and one-half times the strength of a freshly prepared B.P. tincture. The patient was given m.$\bar{x}$ every three hours for five doses, and then m.v three times daily for ten days. Throughout this period the fluid intake was restricted to forty ounces daily and a light diet only was allowed.

At the end of forty-eight hours reduction in heart rate and improvement in the general condition became evident. After ten days the heart rate was 70 to 76 per minute, with a radial pulse rate of only four to six beats less than the heart rate. The oedema had entirely disappeared, as had also the signs of pleural and peritoneal effusions. The patient was able to lie comfortably in bed with only one pillow. The Digitalis was then reduced to m.$\bar{v}$ once daily and the diet increased.

Convalescence was rapid and this patient was discharged on December 23rd., almost one month after admission, feeling very well. The heart rate at time of discharge was seventy-four per minute. While irregularity persisted, the pulse deficit had disappeared and the heart sounds had improved. The urinary findings were normal.

This man has returned to his occupation, being restricted to light work and is experiencing no discomfort. He is having m.$\ddot{ii}$ of the Concentrated Tincture of Digitalis three times a day for nine days out of every fourteen; this being apparently the quantity of the drug required to maintain the equilibrium of the circulation and still not produce any toxic symptoms.

The endeavour is to give just that quantity of Digitalis which will maintain the heart's rate at about seventy, and also keep the patient free from signs of cardiac failure, as evidenced by dyspnoea, oedema and pulmonary congestion.

The case presented is quite typical of a group, in which we have a man of middle age with mitral stenosis and some hypertrophy of the heart muscle, without any definite history of previous infection, who under some slight extra strain suddenly begins to have fibrillation of the auricles, with accompanying evidence of acute cardiac failure and who has still a fair amount of efficient cardiac muscle, as evidenced by the heart's response to rest and digitalis and also by the present capacity for work. This latter is only possible with a carefully regulated life and continuous treatment with digitalis.

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MEDICAL BULLETIN

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VOL. I, NO. 2 MAY, 1921

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UNIVERSITY OF TORONTO PRESS

SPECIAL GRADUATE COURSES

A special course in *Paediatrics* (20 students) will be given from July 4th to 30th (fee $20.00). Applications will be received up to June 12th, 1921.

Instruction in this course will be given in Infant Feeding, Malnutrition in older children, Acute Intestinal Disorders, Congenital and Acquired Heart disease, Infectious Diseases, Nervous Disorders and Syphilis.

The Faculty of Medicine announces the following Special Graduate Courses which will be given from May 23rd to 28th, 1921. The fee for courses 1, 2 and 3 will be $10.00 each, payable on registration. The courses run concurrently and it will therefore be impossible for a candidate to take more than one course. As the courses are limited, applications will be dealt with in the order of their receipt by the Secretary of the Faculty of Medicine.

There are still a few vacancies in these courses.

1.—*Combined Course in Medicine and Surgery.*

Six hours a day for a week will be devoted to these subjects.

In *Medicine* a choice is given of

(*a*) Neurology (20 students).

(*b*) Diseases of the Cardio-vascular system (20 students).

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EDITORIAL

The Graduate Studies Committee of the Faculty of Medicine appreciate greatly the reception accorded to the first number of the Bulletin and are grateful for the letters of appreciation received from a number of members of the profession. Criticism and praise are both welcome.

In the article on Vaccines, a presentation is made to the practitioner of the attitude in the University to this subject at the present day. It should enable him to judge more intelligently when he can use this type of remedial agent with advantage. The carelessness shown in the handling of the cases in the second article indicates the necessity for sounding this note of warning.

Attention is called to the announcement of the Graduate course in Paediatrics to be given next July. General approval was expressed unanimously by the physicians who attended this course last year. The modern knowledge in this subject gained by the general practitioner will prove of definite value to him in his practise.

THE USE OF VACCINES

D. K. Detweiler, M.B.,
(*Department of Medicine.*)

For the purposes of this article, a vaccine may be defined as a suspension of a killed culture of the bacteria with which the patient is infected, or to which the patient is likely to be exposed. It differs fundamentally from a serum in that the latter is used to confer a passive immunity upon the recipient, whereas in the former, the inoculations serve merely to stimulate the recipient's tissue-cells to produce antibodies (active immunization). Many members of the profession have been carelessly using the two terms as synonymous.

Vaccines may be used for either prophylactic or curative purposes. Where they are employed for curative purposes, their value is restricted mainly, if not entirely, to chronic or subacute localized infections, such, for example, as furunculosis and chronic bronchitis. An autogenous vaccine is one prepared from organisms isolated from the lesions of the patient to be treated. A stock vaccine is one made from a "stock" or laboratory strain of the organism concerned. Authorities are agreed that autogenous vaccines are to be preferred in all cases where it is possible to obtain a culture. Obviously they cannot be employed for prophylactic purposes. This is the legitimate field for the stock preparation, which may also be used therapeutically where it is impossible to obtain an autogenous culture. In this connection, attention should be called to the unscientific and lazy habit, all too common among the profession at present, of

choosing a vaccine from a series of "polyvalent" mixtures prepared and advertised by various commercial houses. Apropos of this, the Journal of the American Medical Association says editorially, "Commercially it is much easier to mix all the different bacteria together, to prepare a vaccine, to inject it into the patient, and to hope that some organism will produce antigens which will find a mate. . . . . We used to ridicule the old shot-gun mixture of drugs; the present day biologic shot-gun mixture is much more ridiculous—and a greater menace to public health and to scientific medicine." Care should be exercised in selecting a reliable laboratory to which specimens are to be sent for the preparation of vaccines. It is to be deplored that many physicians pay little heed to this point, often employing the services of a "laboratory" without a single graduate in Medicine on its staff!

Dosage.—Stock vaccines prepared from strains whose virulence is known, can be sent out with more or less definite instructions as to dosage. This fact renders it possible, to set, arbitrarily, a standard of dosage for prophylactic vaccines. Thus, typhoid and whooping cough vaccines, distributed by the Provincial Board of Health, carry definite instructions upon the labels.

On the other hand, in the majority of vaccines for therapeutic purposes, autogenous strains should be used. It is well known that different strains of the same organism vary in virulence, and the dosage must necessarily be a matter of judgment and experiment. It is always wise, when dealing with preparations of unknown virulence, to begin with small doses, and gradually increase the amount according to the local or general reaction observed.

It need hardly be mentioned that where there exist undrained foci of infection, giving rise to the disease under treatment, no amount of vaccine therapy will avail unless combined with proper surgical or other appropriate measures.

Furunculosis.—There is no reasonable doubt left regarding the excellent results obtained by the therapeutic use of staphylococcus pyogenes aureus vaccine in the treatment of furunculosis. The immunity conferred by a thorough course of inoculations is prompt and usually lasting. In patients in whom the disease has existed for a number of years, some difficulty may be experienced in obtaining a complete cure, but in the vast majority of cases the results are striking.

Autogenous vaccines are easily prepared and are preferred to stock preparations, often succeeding where the latter have been previously tried without relief.

In the adult, the initial dose should be 100 million or less, increasing according to the local reaction, to 1 billion or even 2 billion. Inoculations should be made at four or five day intervals and should be persisted in until twelve to fifteen doses have been given.

Pyelitis.—Vaccine treatment for pyelitis caused by infection with *B. coli* and allied micro-organisms has been tried by various observers with splendid results. It is true that others have reported no benefit A large proportion of acute cases promptly subside with the usual treatment of rest in bed, liquid diet, large amounts of water, and Hexanime urotropin, or pot. citrate.

In all instances in which the symptoms and signs persist, *i.e.* all chronic cases, or those with recurring acute exacerbations, vaccine thereapy should be tried. There is usually no difficulty in obtaining the organism in pure culture from which to prepare suspension. The importance of employing an autogenous in preference to a stock vaccine, in these cases, cannot be too strongly emphasized. In the first place, even where the infection has been shown to be due to the colon

bacillus, the autogenous strain is reasonably to be expected to produce a more satisfactory result. In the second place, many cases yield pure cultures of a gram negative bacillus which in many laboratories is presumed to be the colon bacillus, but which in reality is a member of a group which resembles that organism in many respects. Thus, the bacterium isolated is often found, on careful examination, to be *B. lactis aerogenes*, or *B. acidi lactici*. A stock vaccine of *B. coli* would manifestly be unsuitable for the treatment of such cases. It is therefore obvious that fewer cases will be treated with the wrong organism where autogenous preparations are used.

What has been said with regard to the vaccine treatment of pyelitis will also apply to cystitis.

Gonococcus Infections.—Authorities differ as to the value of vaccines in the treatment of gonococcal infections. It is generally agreed, however, that in cases of simple urethritis and infections of other mucous membrances, vaccines are of little or no value. In gonorrhoeal arthritis and epididymitis most observers report favorable results with this form of therapy. It must be stated, however, that certain investigators claim that there is no appreciable advantage of the gonococcus vaccine over vaccines made from other bacteria or even of foreign proteins such as horse serum.

The dosage employed by the different workers varies from 1 million to 1000 million (ordinary polyvalent stock vaccines). In using any prepararion the principles enuniciated above are to govern the dose given.

Owing to the difficulty in obtaining cultures in the cases in which vaccine therapy is indicated, stock vaccines only are practicable in the majority of instances.

Pertussis.—Observers are far from being unanimous as to the efficacy of vaccines prepared from *Bacillus pertussis* in the prophylaxis or the treatment of whooping cough. It is fair, to say that many enthusiastic reports have recently been published and until properly controlled experiments have definitely shown their uselessness (or value) these vaccines will be used by a great many practitioners who believe they obtain good results.

The antigenic value of fresh pertussis vaccine is much greater than that of older preparations. No vaccine should be used after it is four months old. Davison gives the following dosage as most satisfactory:

1. For prophylactic use: Three injections, one weekly, for three weeks. For children, 500, 1,000, and 2,000 million bacilli. For adults 1,000, 2,000 and 3,000 million bacilli.

2. For therapeutic purposes; To a child over a year old an initial subcutaneous injection of 500 million bacilli is given. At the end of forty-eight hours another dose containing 1,000 million is administered, and after the lapse of another forty-eight hours a third does of 2,000 million.

After an interval of five days the child is re-examined. If the paroxysms are much milder but still persist, a dose of 4,000 million bacilli is given, followed by 8,000 million in three days, and 10,000 million in another three days. If the paroxysms become more violent after the first three injections, the dosage of the second series should be halved.

Chronic Bronchitis: It is a matter of common observation that many cases of chronic bronchitis, both with and without asthmatic attacks, are markedly relieved by the administration of vaccines prepared from organisms isolated from

the sputum. Owing to the multitudinous types and strains of the bacteria found in such cases, it need hardly be said that autogenous vaccines are to be recommended.

The commonest micro-organisms found in the sputum of such cases are *Streptococcus viridans* and *Streptococcus non-hemolyticus*. Very often one or other of these present in practically pure culture. Other varieties frequently encountered are *Streptococcus hemolyticus*, *B. influenzae*, *Staphylococcus aureus* and *albus*, *B. Friedlander* and *M. catarrhalis*. The last named has never been shown to possess any great degree of pathogenicity.

In securing sputum for culture, it is important to take precautions against the contamination of the specimen by saprophytic bacteria of the mouth and throat. It is wise to caution the patient to wash out the mouth with water or saline before expectorating into a sterile container. They must also be instructed as to the importance of securing sputum which they are sure has "come from the chest" and not merely from the throat or naso-pharynx.

It is easily understood that where the material to be cultured must first traverse the contaminated throat and buccal passages, the precision with which the laboratory obtains the offending organism is seriously affected, even when the foregoing precautions are taken. For this reason, it is sometimes found that where the first vaccine fails, a second or a third will prove to be efficacious.

Acne.—The reports of the results of vaccine treatment of acne are notoriously conflicting. In a recent symposium upon this subject by British dermatologists there was an almost unanimous agreement as to the uselessness of vaccines. On the other hand, many investigators, particularly in America, have reported very favorable results. Engman sums up the situation for the Council on Pharmacy and Chemistry of the American Medical Association, in a recent article in which he states that in cystic and indurated forms of acne, where the lesions lie more deeply in the cutis, vaccines prepared from the acne bacillus are of decided value. In the more superficial types, *i. e.* acne simplex and acne pustulosa, the effect is less striking. This is attributed to the protection offered to the organisms by the walls of the follicles, rendering them less accessible to the immune bodies in the patient's serum. Other observers attribute the failure in these superficial types to the absence of Staphylococcus albus from the vaccine, believing that this organism bears a direct etiological relationship to the lesions in such cases.

Smears of the pus obtained from the lesions should be stained with Gram's stain and examined to determine the types of bacteria present. If the acne bacillus is found alone, treatment with a vaccine prepared from this organism is rational. Here, as in gonorrhoeal arthritis, the difficulty of securing cultures of the acne bacillus renders autogenous vaccines impracticable in the majority of the cases.

Where the staphylococcus is found associated with the acne bacillus, autogenous cultures can easily be obtained to combine with the acne vaccine.

According to Engman the initial does should be 3 to 5 million acne bacillus. If there is an outcrop of many new lesions within forty-eight hours, the dose should be lessened. The appearance of new lesions after the third day, however indicates the necessity for larger dosage (7 to 10 million). . . . If Staphylococci are used, the dose should be 100 to 500 million. Administrations should be made at 5 to 7 day intervals, and should be combined with suitable local treatment.

A NOTE OF WARNING

J. H. Elliott, M.D.,
(*Department of Medicine.*)

This short communication is based upon two or three cases which have come to the writer's notice and which appear to be of sufficient importance to be brought to the attention of the profession.

Quite recently there appeared in one of our Provincial daily papers a letter from a patient under treatment in an Ontario Sanatorium. He was complaining bitterly that he was now in an advanced stage of tuberculosis with little prospect for arrest of the disease; that if he should be fortunate enough to secure some degree of improvement a long course of treatment would be necessary to fit him for even light work. Yet fully two years previously he had gone hurriedly to a physician's office when suffering from haemoptysis and had been assured that the bleeding was from his throat. Perhaps a year later another haemoptysis occurred which was again passed lightly over by another physician whom he consulted. In each case without an examination of the bared chest, and with only a cursory glance at the pharynx, the "throat" was said to be the cause of the bleeding. He kept on with his usual work and it was only when notably losing weight and strength he again sought advice. By this time he had pronounced physical signs of pulmonary tuberculosis.

Why was this patient not given a word of warning by the physician to whom he applied for advice? It could not be ignorance, for from the time of Hippocrates all physicians have known the aphorism "From the spitting of blood then follows a spitting of pus," and all physicians know that the occurrence of haemoptysis, unaccompanied by other symptoms, in a young person without heart disease, is caused almost always by the presence of a tuberculous focus in the lung.

Last year a man with a rather severe hemorrhage consulted a physician, as he was alarmed at the occurrence. The physician pulled out a chart, showed him the blood vessels in the throat and lungs, explained that the blood came from a small vessel in the throat which had burst, that it amounted to nothing and that he needed more exercise. Six months later he was found on examination to be in an advanced stage of tuberculosis and in a practically hopeless condition.

The spitting of blood in quantity of a tea-spoonful or more is due nine times out of ten to tuberculosis of the lung and is rarely from a vessel in the throat. Tuberculosis is to be considered the cause unless tuberculosis can be positively ruled out.

An initial hemorrhage usually sends a patient to seek medical advice. He is frightened as are the members of his family if made aware of the fact. Whether much or little blood appears, an alarm has been sounded. As an initial symptom it is not generally attended with immediate danger and subsides almost as promptly as it appeared. Fortunate is the patient who seeks the counsel of a physician who recognizes the need for careful examination, for with this due warning the patient as a rule is ready to follow advice, and accept prompt institution of proper treatment—not for his haemoptysis, but for his tuberculosis. At this stage most patients are curable while weeks or months of failure to undertake treatment frequently mean advanced disease with corresponding change in the prognosis and length of time requisite to secure arrest.

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MEDICAL BULLETIN
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UNIVERSITY OF TORONTO PRESS

SPECIAL GRADUATE COURSES

The Faculty of Medicine announce that the following Special Graduate Courses will be given from December 19th to 24th, 1921. The courses will run concurrently, so it will not be possible for a candidate to take more than one course. The fee for each course will be $10.00, payable on registration. Applications will be received by the Secretary of the Faculty until the number to which each course is limited, is reached.

Clinics will be given in the morning and afternoon of each day.

1.—*Medicine* (limited to 30).

The following will be dealt with:

(1) Diseases of the Cardio Vascular System.
(2) Diseases of the Respiratory System.
(3) Diseases of the Nervous System.
(4) Diagnosis and Treatment of the Commoner Skin Infections.

The course shall be limited to a class of thirty, and shall consist mainly of bed-side and theatre clinics. Members of the profession attending the course will be able to attend clinics in the above four subjects.

2.—*Surgery* (limited to 30).

The following subjects will be dealt with:

(1) Gall Bladder and Ducts and Pancreas.
(2) Tumours of the Breast and Thyroid.
(3) Interpretation of X-Ray Plates, Surgical Conditions, and Radiation Therapy.
(4) Examination and Classification of Joints.
(5) Empyema, Surgical Aspect.
(6) Bladder and Kidney Conditions.
(7) Fractures.
(8) Nerve and Head Injuries.

The course will be given in two groups of fifteen men each.

3.—*Obstetrics and Gynaecology* (limited to 10).

The following subjects will be dealt with:

(1) Antenatal care including clinical pelvimetry and diagnosis by abdominal palpation.
(2) Antepartum haemorrhages—Diagnosis and Treatment.
(3) Immediate repair of Obstetrical Injuries.
(4) Late repair of Obstetrical Injuries and Correction of Displacements.
(5) General Gynaecological Diagnosis.
(6) Demonstrations in Gynaecological Pathology.

EDITORIAL

THE Graduate Courses held in December and May of last session met with such hearty approval and support of the profession throughout the Province, that the Faculty of Medicine have completed arrangements for the repetition of a similar course in December.

In order that those attending may gain the greatest amount of value from the courses, only a limited number can be admitted to each one.

Although many of the members of the profession are able to take advantage of the Extension Lectures which are being delivered by some of the Medical Faculty, still it is felt that a week's concentrated work in a large Hospital will supply valuable material to the physicians which it is impossible to present in a single Extension Lecture.

It is hoped that the appeal of the Anatomical Department of the University for human embryos and foetuses will receive the earnest attention and support of the practitioners throughout the Province.

Detailed instructions are given as to the method of preservation. The Laboratory is prepared to defray any expenses that may be incurred in preserving and forwarding specimens.

SUBACUTE BACTERIAL ENDOCARDITIS

LEONARD M. MURRAY

(*Department of Medicine*)

Case Report— November 16th, 1921.

W. L.——Male—Age 28 Years. Complaints—General Weakness; shortness of breath on exertion; pain in the left side on exertion; giddiness.

History

As a child he had measles, whooping cough and scarlet fever. At the age of 12 years he commenced to have recurring attacks of tonsillitis, two or three severe attacks each year. In February 1918 he developed influenza. During this illness he remained in bed for two weeks and was away from his work for one month. He says that since this illness he has never felt absolutely well and has been troubled with the above symptoms to a greater or less extent. The tonsils were enucleated October 1918. Following the attack of influenza he continued at work until two months ago (a period of 18 months); since then he has only been able to work three or four days each week.

Examination

His appearance is not healthy. He is able to lie flat in bed without any distress. Colour light yellow over which is what would appear to be a fairly healthy complexion. The mucous membranes are moderately pale. There are a few small petechial hemorrhages in the region of the left clavicle. Teeth—some Pyorrhoea and considerable evidence of dentistry in the mouth. Tonsils—not evident. Thyroid—not enlarged. Arteries—in good condition. Blood pressure—120-80 mm. Hg. Heart—impulse diffuse 4th and 5th left interspaces extending beyond the left nipple line. There is a coarse systolic thrill in the region of the apex. Dullness—4 inches from midsternum to the left limit. Sounds—at the apex there is a coarse systolic murmur which is heard in all positions of the patient. Along the left border of the sternum there is a systolic and a diastolic murmur. The systolic is heard in the vessels of the neck. Rhythm—Regular; rate 96 per min. Spleen—by percussion enlarged; palpable one half inch below the left costal margin. Liver—not palpable. Kidneys—urine sp. gr. 1018; acid; moderate amount of albumen; no sugar; microscopic—a few red blood cells and a number of hyaline casts. Blood examination—red blood cells 4.200.000; white 14.000; haemoglobin 67%. Temperature 100.5 degrees. The other systems appear to be normal.

Provisional Diagnosis—Subacute Bacterial Endocarditis.

Review of Subsequent History

The following are brief notes of the important events occurring between the date of the above report and his death (November 16th, 1919 to February 8th, 1921).

The physical signs in the heart remained the same, except that the systolic murmur at the apex and along the left border of the sternum became much harsher in character. In addition to the systolic thrill noted at the apex, he developed another systolic thrill in the 2nd right interspace, in the episternal notch and the vessels of the neck.

The pulse remained regular in rhythm; its rate between 90 and 100. The temperature was elevated each day, except for 10 days during the month of March 1920, the average fluctuation being from 98° to 100.5°. Occasionally the maximum elevation reached 102° for two or three days in succession.

Blood Cultures were made on three occasions. The reports by Dr. G. W. Lougheed were as follows:

November 20th, 1919—negative.

December 14th, 1919—negative.

January 16th, 1920—short chain Strepotcoccus with green production on Blood Agar. Nonhaemolytic Streptococcus (Streptococcus Viridans).

On several occasions throughout this period, small punctate hemorrhages were seen on the conjunctiva, mucous membranes and in the skin of various parts of the body.

On January 20th, 1920, he complained of a sudden sharp pain on the palmar surface of the distal phalanx, index finger, right hand. On examination a reddish, hard, tender nodule, half the size of a split pea was found (Osler's Node). He said that when first noticed it felt as if he had been pricked by a pin. Its colour changed from a red to blue and the pain left within two or three days. He subsequently developed a number of these nodes in various parts of the hands and feet.

The spleen remained palpable throughout the illness.

In the latter weeks he had considerable oedema of the back and legs; the liver was enlarged and the bases of the lungs oedematous.

At every examination of the urine albumen, red blood cells and hyaline casts were found.

Blood examination—The red cells were noted as low as 3.700.000; haemoglobin 60%; whites as high as 18.000.

On October 15th, 1920, he developed a right sided Hemiplegia. This was the result of an embolus to the brain. The right side recovered in the course of three or four weeks with the exception of slight weakness in the arm and leg.

On February 3rd, 1921, he had a second embolus to the brain with unconsciousness and paralysis of the right side of the body. He died February 8th, 1921.

The Post Mortem Findings were:

1. Bacterial Endocarditis Mitral and Aortic Valves.
2. Oedema and congestion of the lungs.
3. Infarction of the spleen and kidney.
4. Passive congestion of the liver.
5. Glomerular Nephritis.
6. Embolism of the left middle cerebral artery.

The important features of Subacute Bacterial Endocarditis as illustrated by this case are:

1. The insidious onset.
2. A persistent and monotonous fever.
3. Evidence of a Valvulitis (usually Aortic or Mitral).
4. Enlargement of the spleen.
5. Gross Embolic phenomena (Hemiplegia, Infarction of the spleen and kidneys, Mycotic Aneurysms).
6. Minute Embolic phenomena (petechial hemorrhages, Osler's Nodes).
7. Nephritis of a type peculiar to this condition. (Clinically it is characterized by the presistence of red Blood cells in the urine).
8. The result of Blood Cultures. Negative cultures will not exclude the presence of this disease; positive ones are confirmatory evidence in a suspected case.

AN APPEAL

This is an appeal to the members of the Medical Profession in the Province of Ontario for aid in building up the collection of human embryos in the Anatomical Laboratory of the Provincial University.

The Laboratory already possesses the nucleus of such a collection. Without any organized appeal it has received from various members of the Profession within recent years, some *eighty* specimens, among which were several of great interest. At present the story of human development is far from complete; it shows large gaps which can be filled in only by conjectures based on what has been ascertained from other mammals. The knowledge of man's embryological development is too important to be allowed to remain in this condition. It holds the key to the correct understanding of the antenatal physiological processes and gives a comprehensive insight into the relations of the parts composing many of the complex adult organs, such as the brain or heart.

And of equal importance to the study of normal embryos is that of such as show pathological modifications, anomalies, defects and monstrosities. In many cases these are due to a faulty implantation of the embryo and extensive study of them is essential for a better understanding of antenatal pathology. Descriptions of individual specimens are of very subordinate value in this connection, comparison of large numbers of cases being necessary for useful results.

Several of the Anatomical Laboratories in the United States have embryological collections of some hundreds of specimens, but in Canada, as yet, no large collection exists. In the Laboratory at Toronto a beginning has been made and it is felt that the time has come when there should be opportunities for embryological instruction and investigation in the Provincial University equal to those to be found in institutions which are its friendly rivals. It is to physicians and surgeons in active practice that the Laboratory must look for aid in attaining

this objective. The doctor called to attend an early miscarriage or operating for a tubal pregnancy, has opportunity to secure material whose careful study may serve to fill some of the gaps in our knowledge of human embryology, and this is an appeal that such material may be sent to a Laboratory where it may be made fully available for instruction and investigation.

Every specimen received at this Laboratory is duly catalogued, together with the name of the donor and such data as may be furnished as to the conditions under which it was obtained. Specimens of suitable size are cut into serial sections, stained and mounted on slides for microscopic study and reconstruction, while larger ones are stored, to be used as required for the study of special organs or regions. All such preparations will be freely available for study; considerable use has been made of the material already in the collection; two important monographs based upon it having been published and reconstructions having been made of many organs and parts, these latter awaiting the acquisition of further material for comparison and elucidation.

Embryos and fetuses of all ages are desired, but the greatest interest lies in those in the earlier stages of development, *i.e.*, in those of the first ten weeks which are approximately 2 in. or less in length. To insure that the specimens sent are in good condition for study the following steps are suggested:

1. As soon as possible, place the specimen in several times its bulk of 10% formalin.

2. If the embryo can be clearly distinguished, so that it will suffer no injury, the chorion and membranes should be opened and the amniotic fluid allowed to escape. But in the younger specimens it will be better to have the chorion unopened.

3. Place a pad of cotton on the bottom of a wide mouthed bottle of suitable size, pour in a little 10% formalin, transfer the specimen to the bottle, which should then be completely filled with the formalin and securely corked or sealed.

4. Ship to:

The Anatomical Laboratory,
University of Toronto,
Toronto.

5. Forward to the same address a clinical history of the specimen, data as to its probable age being especially desirable.

The Laboratory will gladly make good any expenses that may be incurred in preserving and forwarding specimens.

J. Playfair McMurrich,
Director of the Anatomical Laboratory.

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Dr. J. W. Hipwell.
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University of Toronto

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UNIVERSITY OF TORONTO PRESS

COURSES—DIPLOMA OF RADIOLOGY

The Faculty of Medicine, University of Toronto, has instituted a graduate course leading to a Diploma in Radiology.

Candidates for the Diploma are required to

(*a*) Be graduates in Medicine of this University or some other University recognized for this purpose by the Senate.

(*b*) Have spent at least one year after graduation as an interne in a recognized hospital.

The Curriculum leading to the Diploma extends over one Winter session of eight months.

The session will be devoted to courses in:

PHYSICS

The instruction in Physics will consist of three courses of lectures accompanied by practical work in illustrative experiments.

The lecture courses are as follows:

1.—*Radiation.*

In this course of lectures there will be discussed:

(*a*) The origin of radiations, (*n*) the properties of various types of radiation, including infra red, ultra violet and visible rays; (*c*) absorption of radiations; (*d*) fluorescence and phosphorescence.

2.—*Electricity, Magnetism and Roentgen Radiology.*

This course of lectures will consist in the treatment of (*a*) the fundamental idea of charge of electricity, difference of potential, electromotive force, capacity, current and inductance; (*b*) the effects of electrical currents with particular attention paid to electromagnetism and the application of the latter in various measuring instruments; (*c*) detailed study of the principles underlying motors, dynamos, and other instruments used in X-ray technique; (*d*) the properties of electrons—the production of X-rays, and the properties and quantitative measurements of these rays.

3.—*Radioactivity.*

This course of lectures will consist of the (*a*) isolation of radiactive substances; (*b*) radiations (L.B. and X-rays) emitted by radioactive substances and quantitative measurements of these three types of rays; (*c*) properties of radioactive emanations from radium, thorium and actinium; (*d*) radioactive transmutations generally with applications to selected problems.

RADIOLOGY

(1) *Anatomy.*

A detailed study in normal Anatomy from a Radiological aspect in infancy, adult life and old age. The ephyiphyses; appearance of the skeleton from various angles together with many abnormalties which do not constitute pathological processes; the changes which normally occur in bones and joints with advancing age and in old age. The normal anatomy of the thoractic and abdominal viscera, etc.

(2) *Pathology.*

A course in co-operation with the Department of Pathology in which a

special study will be made of the pathology of all diseases which come within the range of X-ray and Radium methods either in diagnosis or treatment. In the latter a study will also be made of the histological changes brought about by X-ray or radium applications to various tissues.

(3) *Technique.*

A complete course in the technique of Radiography. Ample facilities are provided for the student to personally carry out all procedures and to perfect himself in this side of the work. In the later part of his course he will be expected to take entire charge of one of the operating rooms.

(4) *X-ray Interpretation.*

In addition to the daily routine of plate interpretation there is now a classified library of several thousand plates including nearly all the unusual and interesting cases to be met with and these will be studied systematically. There is also an almost unlimited collection of other plates which are available for study.

(5) *X-ray Therapy.*

A complete course in Therapy is provided. This will include all aspects of this work from the superficial to the intensive use of voltages up to 250,000 together with the methods of measurement and calculation of all dosages. The material available for this study is very large and diversified.

(6) *Radium.*

A course in Radium Therapy which for the present is limited to the use of Radium element.

(7) *Short Courses in Medicine and Surgery.*

As in Pathology, so in Medicine, Surgery and Gynaecology, courses will be arranged in collaboration with those Departments for Systematic lectures and study of the various diseases or conditions under consideration in order that the student may be presented with the entire problem in its broader aspect.

Examinations on the subjects of the curriculum will be held at the end of the session.

Candidates who have passed the examinations and who present certificates of having satisfactorily completed the work specified will be granted the Diploma in Radiology.

SHORT COURSES IN RADIOLOGY

In order to meet the needs of those graduates in medicine who desire short courses of instruction in Radiology, it has been arranged to provide three courses a year of one month each at the Toronto General Hospital. Classes will be limited and an intensive schedule has been outlined to include:

(*a*) Radiographic Technique.

(*b*) Interpretation.

(*c*) Gastro-Intestinal Examination.

In these courses the entire resources of this large clinic will be placed at the disposal of the student in the most practical manner possible.

The dates are as follows:

1st Course February 15th to March 15th, 1922.

2nd Course Month of October 1922.

3rd Course Month of January 1923.

For full information and terms apply to the Secretary of the Faculty of Medicine, University of Toronto.

ACUTE INFECTION OF THE TENDON SHEATHS OF THE HAND

DR. GEORGE WILSON

(*Department of Surgery*)

Of the numerous surgical conditions of the hand, infection of the tendon sheaths deserves special consideration, for not only are they frequently the site of a pathological process, but when so involved great crippling of the hand may result.

Each flexor sheath begins just distal to the terminal interphalangeal joint of the four fingers and thumb. In the case of the index, middle, and ring fingers, the sheath extends about an inch into the palm before it ends. When the sheath for the little finger reaches about an inch-and-a-half into the palm, it suddenly enlarges to form what is sometimes called the ulnar bursa. It then passes under the anterior annular ligament ending about an inch above the upper margin of the ligament. In like manner the sheath for the thumb passes along the outer margin of the palm, where it is known as the radial bursa, and continues under the annular ligament as far as the sheath for the little finger.

In the majority of instances seen in civil practice the infection is carried by the lymphatics from some superficial area of inflammation. Very frequently there will be a history of a slight wound, often nothing more than a pin prick, over the front of the middle or terminal phalanx, and in twenty-four to thirty-six hours, streptococci have reached the tendon sheath, producing a violent grade of inflammation; inasmuch as the lymphatics travel from the volar to the dorsal surface of the fingers, it follows that an abrasion of the back of a finger is not so likely to be complicated by an involvement of the sheath.

The signs and symptoms of an infected tendon sheath vary somewhat with the sheath involved. A day or two after the initial injury the pain becomes quite severe, and systematic evidences of infection may be present. The whole finger becomes swollen, red, and oedematous, especially on the dorsum where the tissues are more lax. The adjacent fingers soon swell, and oedema and redness appear on the back of the hand, while the fingers take up a position of moderate flexion. With such a picture the possibility of an infected tendon sheath must be kept in mind, and a positive opinion arrived at without any delay whatsoever, since if the tendon sheath is distended with pus, an immediate incision must be made if disaster is to be avoided.

On examining the hand the patient will probably tell you that wherever there is swelling, palpation hurts, but points of extreme tenderness must be sought for. Knowing the limits of the sheath, if there is excruciating tenderness along its course, and especially towards its proximal end, the probability of an infected sheath is very great. If in addition very severe pain, again localized to the sheath, is complained of when the examiner straightens the finger, the diagnosis is practically certain, and an immediate incision is indicated. When the process starts in the little finger in addition to the signs enumerated above, there is an extension of the exquisite tenderness to the ulnar side of the palm and above

the anterior annular ligament. On account of the dense palmar fascia one would not expect to find any bulging in the palm, but there is marked oedema with redness on the back of the hand. Above the annular ligament besides the tenderness some swelling is not infrequent, since the deep fascia is not so resistant. Fluctuation is of no value in acute teno-synovitis. Similarly when the thumb sheath is invaded the line of very severe tenderness extends up the radial side of the palm and above the anterior annular ligament. In connection with pain, it is important not to be misled by finding on a subsequent examination that it is less, for it often means that the condition is worse, in that the nerve endings are paralysed by the intense toxaemia. Consequently, unless corroborated by lessening of the swelling and other signs of recovery, decrease in pain means an incision.

The treatment of suppurative teno-synovitis is incision under a general anaesthetic, and just as early as it is possible to make a diagnosis. In the case of the index, ring, or middle finger, the incision should be made in mid-line, so as to expose the whole of the sheath, and establish free drainage. No drainage tube should be inserted, but the finger should be placed upon a dorsal splint, which will serve the double purpose of preventing the prolapse of the tendon, and aiding drainage by keeping the edges of the wound apart. The part is then covered with a hot moist antiseptic dressing, and bandaged. The nature of the antiseptic used in making the moist dressing is not of any great moment, provided it is non-irritating, because the important factor is moist heat, and a saturated solution of boracic acid in normal saline is as good as any. Under no circumstances should oiled silk be wound about the dressings before the bandage is applied as it increases septic absorption. As soon as the patient has recovered from the anaesthetic the hand should be immersed at regular intervals during the day in a hot bath of boracic and saline. It should not be kept in continuously, as in so doing the hand becomes so oedematous as to interfere materially with the circulation, and retard the healing. A good plan is to immerse it for half an hour, then out for an hour in a wet dressing, then back into the bath for another half hour and so on. At night it is wrapped in a moist dressing and bandaged. General measures devised to promote elimination by the kidneys and bowel are indicated.

When dealing with a little finger infection the incision is an extensive one, and should run from the base of the terminal phalanx up along the palm to the upper margin of the anterior annular ligament. Should the thumb be the part affected, the sheath is opened up from the terminal phalanx along the outer side of the palm, stopping one inch from the lower border of the annular ligament, so as not to injure the nerve supply to the thenar muscles. The upper portion of the sheath is opened by an incision in front of the lower end of the radius and dissecting inwards anterior to the Pronator Quadratus muscle and behind the tendons, vessels and nerves.

Failure to recognize pus in a tendon sheath leads to certain complications depending to a great extent upon the finger involved. The weakest spot in any of the tendon sheaths is the proximal end, so that after pus is pent up in a sheath for a few hours it escapes to the tissue in the immediate vicinity of the upper end. In the case of the index, middle, and ring fingers an abscess forms in the palm

between the tendons in front, and the anterior surface of the distal ends of the second, third, and fourth metacarpal bones behind. To open such an abscess an incision is best made for one inch and a quarter upwards from the web between the middle and ring finger, avoiding the tendons, and then shoving a pair of closed curved forceps under the tendons in whichever direction the induration and tenderness indicate.

If suppuration in a tendon sheath is quickly recognized and the pus promptly evacuated, there may be almost complete restoration of all movements. As a rule, however, some loss of flexion of the interphalangeal joints is to be expected. In bad cases the tendon may slough, and eventually come away, in which event the finger will be useless and will require amputation.

As soon as the inflammation has subsided the wet dressings should be discontinued and the part wrapped in gauze, the inner layers of which are saturated with a 1-8 solution of Balsam of Peru in castor oil. As soon as possible after the subsidence of the inflammation, the patient is encouraged to move the fingers. He may be assisted by a little passive motion, but the main reliance must be placed on getting the patient to move the joints himself. After the incisions have healed the best treatment is to have the individual engage in some occupation which necessitates the free use of the parts which have been damaged, and at the same time impressing upon him the fact that upon his own efforts to a large extent depends the amount of function recovered.

UNIVERSITY NEWS

The Christmas holidays have come and gone and with them the meetings of many of America's great scientific societies. The readers of the BULLETIN will have seen that the University of Toronto entertained this year one of the greatest of America's societies, the American Association for the Advancement of Science, and will rejoice with us, of the University, that J. P. McMurrich, Professor of Anatomy was honoured by being elected as its President. Professor W. Lash Miller was elected Chairman of the Section of Chemistry, while Professor J. C. McLennan served as President of the American Physical Society and Chairman of that Section. Dr. C. K. Clarke, long Dean of the Faculty of Medicine, was Chairman of the Section of Medical Sciences.

The Staff of the Faculty of Medicine was well represented in the list of papers. One of our more recent members, Professor T. W. Bridges (Psychology), reported his studies on Tests of Intelligence as applied to University Students. Professor Huntsman (Biology) read two papers before the Zoologists and Professor Olmsted of the Department of Physiology both read a paper and gave a most interesting demonstration of the effects of changing the position of the head and neck on the tonus of muscles which enables an animal to stand and move.

Away from Toronto, too, at Yale where the American Federation of Experimental Biologists were meeting, Toronto was well represented. Professor Macleod, President this year, was again elected for next when this body, which

includes the Physiologists, Biochemists, Pharmacologists and Experimental Pathologists, will meet in Toronto. The Staff of these Departments in Toronto contributed eight papers. One was read by Dr. F. G. Banting, as a result of work carried on by himself and Mr. Best with Professor Macleod, on an endeavour to establish the presence of an internal secretion of the pancreas whose deficiency would form the cause of diabetes mellitus. The hypothesis put forward by Dr. Banting was that from the whole gland other observers had not obtained this important secretion because of the presence of the tissue which produces the digestive ferments. He secured the degeneration of this tissue by tying the pancreatic ducts in dogs and allowing degeneration to take place. From the degenerated pancreas a highly active extract was obtained which will free the urine of a diabetic dog from sugar and also lower the amount of sugar in the blood stream. This is a highly important observation and, should further experimentation prove successful, a way for the relief of diabetes in man may be the outcome.

Professor Harding (Pathological Chemistry) took a definite step forward in the explanation of the presence of creatin in the body. Dr. N. B. Taylor (Physiology) reported a most interesting case of a student who, by the exercise of his will, could increase his heart rate and cause sugar to appear in the urine, etc. Evidently he could influence his sympathetic nerves by the exercise of his brain. The careful study of this case will throw a great deal of light on many unexplained facts in nervous diseases.

Dr. Warner, in conjunction with Professor Olmsted (Physiology), called attention to a new and interesting phase of the study of muscle reflexes. Professor Henderson (Pharmacology) reported on some experiments designed to throw some light on the therapeutic use of atropine.

The progress, thus manifested, made in medical research in Toronto during the past year cannot fail to increase not only the reputation of the staff of the University but also their efficiency as teachers.

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University of Toronto
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NAUSEA AND VOMITING IN PREGNANCY - 4

V. J. Harding
Department of Pathological Chemistry

UNIVERSITY OF TORONTO PRESS

SPECIAL GRADUATE COURSES

The Faculty of Medicine announce that the following Special Graduate Courses will be given from May 22nd to 27th, 1922. The courses will run concurrently, so it will not be possible for a candidate to take more than one course. The fee for each course will be $10.00, payable on registration. Applications will be received by the Secretary of the Faculty until May 1st, 1922.

Clinics will be given in the morning and afternoon of each day.

1.—*Medicine* (limited to 30).

The following will be dealt with:

(1) Diseases of the Cardio Vascular System.
(2) Diseases of the Respiratory System.
(3) Diseases of the Nervous System.
(4) Diagnosis and Treatment of the Commoner Skin Infections.

The course will be limited to a class of thirty, and shall consist mainly of bed-side and theatre clinics. Members of the profession attending the course will be able to attend clinics in the above four subjects.

2.—*Surgery* (limited to 30).

The following will be dealt with:

(1) Head—Injuries—Fractures of Skull.
(2) Chest—Empyema.
(3) Abdomen—Acute Abdominal Conditions.
(4) G.U.—Cystitis—Haematuria.
(5) Extremities—Fractures—Joints.

The course is intended largely to cover the questions of diagnosis of surgical conditions, and the treatment of emergency conditions. It is designed to meet the needs of the general practitioner.

3.—*Obstetrics and Gynaecology* (limited to 12).

The following will be dealt with:

(1) Antenatal care, including clinical pelvimetry and diagnosis by abdominal palpation.
(2) Toxaemias of Pregnancy—including Eclampsia and Pernicious Vomiting.
(3) Immediate Repair of Obstetrical Injuries.
(4) Late Repair of Obstetrical Injuries and Correction of Displacements.
(5) General Gynaecological Diagnosis.
(6) Demonstrations in Gynaecological Pathology.

A special course in Paediatrics (25 students), will be given from July 3rd to 29th (fee $50). Applications will be received up to June 15th, 1922.

EDITORIAL

ONE of the most worrying symptoms with which the general practitioner meets in his daily rounds is the nausea and vomiting that occurs in the early months of pregnancy. Innumerable empirical therapeutic measures have been suggested for its relief but the results from each and all are unsatisfactory.

In the more serious form of pernicious vomiting, the physician's best efforts have often proved unavailing. The cause and treatment of this distressing and at times serious condition have now been placed on a scientific basis by Prof. V. J. Harding, whose excellent practical article we are able to publish this month. Every physician should be able to understand the method of treatment he describes and apply it in his practice.

NAUSEA AND VOMITING IN PREGNANCY

V. J. HARDING

(*Department of Pathological Chemistry*)

There is an old medical maxim which says "A sick pregnancy is a safe one", and, like most old maxims, it has in it a portion of the truth. It is true that if a pregnant woman is nauseated and vomiting, the foetus is alive. The symptoms of this condition disappear immediately upon the death of the foetus. But it should never be considered that a sick pregnancy is a normal one. The nausea and vomiting which accompany child-bearing in so many women is a question of temporary disturbance of metabolic balance and can be corrected by alterations in the diet, and if suitable precautions are taken, there is no need for any woman to go through a period of sickness in the early months of her pregnancy. The metabolic disturbance in simple cases of morning sickness, and nausea with occasional vomiting is accompanied by the appearance of acetone bodies in the urine. These are usually taken to be a sign of starvation resultant upon the vomiting itself, but this is only partially true. They occur also because the carbohydrate supplies of the maternal liver are of themselves disturbed. The acetone bodies which one finds in the urine, then, have a double meaning. They themselves are not to be regarded as the cause of the vomiting and the nausea. They accompany the nausea and the vomiting as a symptom of disturbed carbohydrate metabolism in the maternal liver. The influence of starvation is shown by the very term of "morning sickness", in that it arises after a period of overnight fasting, that is, a period of short starvation. The treatment of this simple, yet distressing, condition lies in maintaining the carbohydrate balance of the mother, by placing her upon a diet rich in cereals, vegetables and fruits, and excluding for a day or two all meat and fats. Accompanying this, is advised also the copious ingestion of water or fluids in general, to the extent of 3 pints a day, and care is also paid to the bowels, by ensuring a gentle daily movement. Any mild cathartic which the patient prefers will serve this purpose. Usually three or four days of such a diet will completely restore the carbohydrate balance of the mother, especially if *the diet is taken in a number of small meals throughout the day, instead of the usual three*, and her nausea will disappear. She may then include meat in her diet, once or twice a day, but always there should be a preponderance of fruits, vegetables and cereals. In many women, however, the vomiting progresses beyond this simple condition, and the patients are unable to take food. In most of these a second factor enters, and it is a factor which is called "neurotic".

Rest in bed is advised at once, and if it seems that the patient is likely to become difficult to manage, isolation in hospital is resorted to. This neurotic factor in nausea and vomiting of pregnancy is a heightened sensitivity of the sympathetic nervous system, and as such, reinforces the metabolic fault which has just been alluded to. No attempt is made to feed these patients by mouth; they are fed by bowel, giving in the morning, first a cleansing enema, followed by a nutrient enema of 10% glucose in saline, 6 oz. to 8 oz. t.i.d. A little bromide may be added to the night enema to ensure sleep, or, if the neurotic factor is very marked, bromide may be given grs. 30 to 40, t.i.d., with each nutrient enema. At the same time, every advantage is taken of the patient's ability to drink water or fluids, and 3 pints of fluid a day are urged. Homemade lemonade, orangeade, weak tea, ginger ale, grape juice or water, in fact, any fluid which the patient finds she can drink the most easily, may be given, except strong tea, coffee, cocoa, or milk. It is the amount of fluid which matters, rather than its nature. With each glassful of fluid may be given one or two teaspoonsful of lactose, unless the patient finds that this slight sweetness of itself becomes a little nauseating. It will be found also, very frequently, that the patient takes one fluid one day, and another fluid the following day. Three or four days of this treatment will usually ameliorate the condition, and the patient begins to feel hungry. To begin with, the feeding consists of a little mashed potato, or a few crackers or toast, with a little jam or marmalade, the feeding thus beginning with pure carbohydrates. These small amounts of carbohydrate are usually well tolerated after the fast, and gradually the amount of food is increased, adding in progression cereals, vegetables, then chicken or fish, and finally the ordinary meats. The amount of fat in the diet, however, must be kept low, consequently all foods of a greasy or fatty nature are avoided,—even butter is kept down to a minimum amount. The enemata are continued until the patient is taking food, and while the acetone bodies are still found in the urine. After that, they may be gradually withdrawn, the night enema being retained to the last. These two types represent mild and moderate cases, which can be easily and successfully treated on these principles.

If the case has been allowed to progress, however, it may have passed over to the more severe stage, when it receives the name of "pernicious" vomiting. Here it is impossible for the patient to take any food whatever by mouth, and very often even fluids are not retained. The lips are usually dry and cracked, the tongue furred, the breath foul, and the skin dry and harsh. Very often also, the conjunctivae will show bile-stain, and there will be more or less epigastric pain. The vomitus is frequent, and is bile-stained—sometimes it may be flecked with traces of blood. Isolation in hospital is recommended immediately for this class of patient, and very often the mere removal to the hospital will have a beneficial effect. The treatment of the pernicious cases follows the lines of the treatment of the moderate cases. The bowels are cleansed, and nutrient enemas 10% glucose in saline, 6 to 8 oz, t.i.d. are given, with bromide if indicated. Water and fluids are urged by mouth as in the previous cases. Very often the apparently pernicious cases clear up in a manner similar to the moderate ones, but it is not safe to rely on this, and if two or three days of treatment of this nature do not produce an improvement, and

if the signs of dehydration are still present, use must be made of glucose intravenously. Care must be taken in the preparation of solution of glucose for intravenous use. The glucose used must be pure, and it is better to sterilize the physiological saline first, and then to add to it the requisite amount of solid glucose, and resterilize for a short period. The solution when ready for intravenous use, should be perfectly bright and clear, and should not be caramelised. 1,000 c.c. of 5% glucose in saline are used for an intravenous injection. The injection is given very slowly, so as not to embarrass the action of the heart. If these directions are followed there are no undesirable after reactions. The intravenous route can be made use of several times in order to supply water and carbohydrates. But its use should not be continued whenever it becomes possible to supply water by mouth to the patient. Occasionally, use is made of an interstitial injection of glucose, 500 c.c. 10% glucose in saline being given. The interstitial glucose is very painful, and should not be resorted to more than twice. It sometimes has a distinct value on a refractory patient. The pernicious cases of vomiting improve rapidly under this treatment, and as soon as possible, small amounts of carbohydrate food are fed by mouth, exactly as in the treatment of the more moderate type. From there onward, the treatment differs in no detail from the previous cases. It is a distinct help in cases showing moderate or pernicious vomiting to be able to follow the course of treatment day by day by examination of the urine. A routine examination of the urine is always made at the beginning, and it will be found that all of the moderate and all of the pernicious cases show acetone bodies in the urine. The mild cases usually show acetone bodies in the morning specimen. A trace of albumin is also very often found in the moderate and severe types, and small amounts of bile in some of the pernicious cases. With the continuance of treatment and its success, there comes a diminution in the intensity of the tests for the acetone bodies. Much more significant, however, than the excretion of the acetone bodies, is the specific gravity of the urine from day to day. The moderate and severe cases all show urine of high specific gravity and any cases which show a urine with a specific gravity of 1,024 or over, should be classed as "severe", independently of the symptoms. The effect of the glucose and the water is to increase the volume of urine and to lower its specific gravity, and invariably with the success of the treatment, the specific gravity falls to around 1,010 or under. This point is an important one, as it gives an indication for the necessity or otherwise of a therapeutic abortion. A patient who reacts well towards water and glucose, and whose urine shows a diminution of the acetone bodies, and a marked lowering of the specific gravity, should never be aborted, as a therapeutic measure for vomiting. On the other hand, if, in spite of vigorous treatment, the acetone bodies continue high, and the specific gravity remains high, we should regard it as an indication for the necessity of therapeutic abortion. Usually the results show themselves within a period of six or seven days at the outside. So that this method of treatment, not only gives successful results in practice, but it allows of a control which indicates the necessity for interference. It may be said that, during the past year in Toronto, 135 cases have been treated according to the lines indicated, by different obstetricians, with only nine failures.

DIET INSTRUCTION SHEET

The patient may exercise her choice of food under the following directions:

Cereals. Oatmeal porridge or any of the patent breakfast foods, taken with milk.
Brown or white bread. Toast. Rusks. Cream crackers, biscuits.

Vegetables. Any vegetable in any form except fried.

Fruits. Any fruit, either fresh or stewed.

Meats. Lean Bacon or Ham.
Beef, Lamb, Mutton, Veal. (No Pork).
Chicken (Avoid Duck, Goose, Game).
Any fish except Salmon, Mackerel.
Eggs.
Croquettes or Rissoles if not fried in deep fat.

Soups. Any soup, thick or clear, but free from fat.

Sweets. Any jam or jelly. Marmalade or Honey.
Milk Puddings. Boiled pudding occasionally.
Pies or tarts may be taken occasionally (twice a week) but rich cakes and pastries must be avoided.

Salads. Any salad, but sparingly of salad dressing.

Fluids. Water, aerated water, home-made lemonade, orangeade, weak tea, coffee. Milk if desired. No alcohol of any kind.
Butter may be taken if desired, but not in large amounts. Cream, fat meats, and any fish fried in deep fat should be avoided.
Fruits and vegetables must be taken at least twice a day, and meat not more than once a day.

A few books from the list of publications of the
UNIVERSITY OF TORONTO PRESS

Bensley, B.A.—The Anatomy of the Rabbit - - ($3.00)

Fraser, Hartman and Macleod—Laboratory Manual of Physiology - - - - - - - - ($2.75)

Henderson, V. E.—Materia Medica and Pharmacy ($2.50)

McMurrich, J. P.—A Guide to the Dissection of the Human Body - - - - - - - - ($1.00)

Rudolf, R. D.—The Medical Treatment of Disease ($4.00)

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VOL. II, NO. 4 MAY, 1922

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Department of Surgery

UNIVERSITY OF TORONTO PRESS

GRADUATE COURSE IN PAEDIATRICS

JULY 3RD—28TH

In post graduate instruction it is the aim of the Staff in Paediatrics to teach fundamental principles as much as possible illustrating common everyday occurrences in general practice. The showing of unusual cases, which are only of academic interest, is avoided.

The bedside teaching consists of the routine methods of diagnosis, general management and treatment of feeding defects, deficiency diseases, acute intestinal diseases, breast feeding technique, acute respiratory diseases, conditions arising following focal infection, such as heart disease, laying special emphasis on prophylactic measures.

The teaching in the Out Patient Department is devoted to the diagnosis and treatment of the simpler conditions arising in childhood such as otitis media, bronchitis and common feeding disturbances.

Applications will be received for the above course by the Secretary of the Faculty of Medicine, up to June 15th, 1922. The fee for the course is $50.00.

THE DIETETIC TREATMENT OF CHRONIC ARTHRITIS

A. A. FLETCHER

(*Department of Medicine*)

The treatment of chronic arthritis by special dietetic measures, which was at one time in general use, has in recent years tended to fall into disfavour. This is partly due to the growing conviction that the disease is a bacterial process, for, although its etiology has not been definitely established by laboratory investigation, recent workers have furnished much evidence to support the infectious theory. As a result of this, treatment is now directed more toward the search for foci of infection and their removal if possible, and other measures have been employed, such as vaccine treatment, which might be expected to be of value in a chronic secondary infection. Radical treatment of foci of infection is undoubtedly the most effective procedure in many cases, but frequently it exerts little or no benefit, and besides this, many cases are seen in which no focus can be found. The value of dietetic treatment has also been confused by the failure to distinguish between gout and the true arthritides of the non-specific type, and the restriction of protein, especially meat, has been productive of much harm in many cases of the latter group.

At the General Hospital during the last two years, special observation has been made upon the effect of dietetic regulation in this disease. The cases studied represented practically all the non-suppurative types of arthritis admitted to the medical wards, excluding those due to a definitely known infecting agent, such as the gonococcus, tubercle bacillus and spirochaeta pallida, the majority belonging to the group generally known as "Arthritis Deformans," that is to say, Rheumatoid Arthritis and Osteoarthritis. The restriction of carbohydrates, as recommended by Pemberton, was found to be useful in many cases, but the best results were obtained by a general reduction of diet. The essential element of such a diet is an adequate amount of easily digested protein, such as milk, supplemented by fresh fruit or vegetables, and the following procedure has been carried out in the dietetic treatment of the majority of cases studied: for one week, 6 glasses of milk, or three of milk and three of buttermilk, one orange, half a grape fruit per day; then a gradual increase in the diet, adding various fruits and vegetables, soups, eggs, fish, fowl, meat in moderation, junkets, and finally brown bread in small amounts, so as to give a daily intake of 1,500 to 2,000 calories in four weeks' time. Those who were especially underweight were allowed, in addition, cod liver oil and cream. Comparative rest, preferably in bed, was enforced throughout the course of treatment, and in a few cases, measures were required to relieve constipation—usually liquid paraffin and enemata on alternate days. Of the first 100 cases so treated, eight recovered, forty-three were much improved, twenty-eight showed some improvement, and

twenty-one were apparently uninfluenced. The twenty-eight cases which were improved obtained relief from some of the symptoms of the disease, chiefly pain, and besides this usually they reported some betterment in their general health. The forty-three cases, much improved, showed this progress on examination as evidenced by decreased swelling, decreased limitation of movement or relief of muscle spasm. In a few of these cases, the improvement is almost immediate and quite striking. Sometimes, on the other hand, it sets in slowly, and is not well marked until toward the end of the four weeks' period. Improvement in general health is often a marked feature of the progress; patients will often be relieved also of the chronic gastro-intestinal symptoms, which are so common in chronic arthritis. The further handling of the case after the period of four weeks depends upon the result of treatment. If no benefit has been observed by this time, further dietetic treatment is not indicated, but if the treatment has resulted in well marked benefit, careful regulation of the diet along the lines described appears to give the best final results.

Our results have demonstrated the importance of dietetic treatment in chronic arthritis, but it is clear that there are many cases which derive little or no benefit by these means. It has been found that there are certain points which indicate the prospect of a favourable result by dietetic reduction. Firstly, patients, who are much overweight, are almost always favourably influenced by this form of treatment, and with these it is desirable to carry on with the restricted diet until a very material decrease in weight has been observed. Secondly, when evidence can be obtained from the patient of some definite lack or unbalance in his diet, dietetic regulation is indicated. The usual dietetic error which is found to be associated with this disease is an excess of carbohydrate food, combined with inadequate protein and vitamine. The most useful indication for the dietetic treatment outlined has been the determination of the sugar tolerance, that is to say, the determination of the variation in blood sugar following the standard glucose meal. Following the administration of 100 gms. of glucose, a rise is normally seen from the fasting blood sugar level of .06 to .1%. This rise does not go above .17% and returns to normal in 90 minutes. In most cases of chronic arthritis, it has been found that this curve rises considerably higher than .17% and as a rule does not return to normal within three hours. Patients with a marked decrease in their sugar tolerance, that is to say, those showing a high and prolonged rise in the blood sugar curve, are almost always favourably influenced by dietetic reduction. This determination has been a most useful indication for the value of dietetic treatment in individual cases.

SPRAINS

HAROLD WOOKEY

(Department of Surgery)

Definition

A sprain is an injury to the soft tissues of the locomotor system produced by stress, the result of sudden violence directly or indirectly applied.

Such injuries are commonest in the neighbourhood of joints, because of the great range of movement and the fixation of capsule and ligaments close to the articular lines.

Aetiology

Sprains are the result of either excessive, unguarded or abnormal movements.

Movements of joints are controlled by muscular action and guarded by muscular tone, as a result, normally a minimum of strain is thrown on the capsule and ligamentous structures which constitute a second line of defense. When the strain is excessive, the muscular protection is overcome. The muscle usually relaxes, or may tear in some part of its structure, and the strain is then borne by the non-elastic ligamentous tissue. If the force is sufficient, ligaments, capsule, and synovial membrane are torn, the degree varying from rupture of a few fibres of a ligament to a gross laceration of the capsule and synovial membrane. The ligaments and capsule of a joint do not stretch on sudden stress, but may after the strain is prolonged on the tissues altered by inflammatory reaction. If the movement is unguarded the strain is at once thrown on the fixed tissues. Abnormal movements, such as torsion of the knee, are always quite unprotected by muscular action, and a comparatively slight force will cause a sprain.

Pathology

When a strain occurs, blood is always extravasated into the tissues about the joint or into the synovial cavity itself. This is usually followed by a simple inflammatory reaction, which in the majority of cases results in complete repair of tissue and restoration of function. When improperly treated, recurring attacks of pain, persistent weakness or limitation of movement result from non-union of the torn fibres and adhesions in or about the joint. Tuberculous disease, or some form of arthritis may follow such injury.

The Diagnosis, after fracture has been eliminated, depends on tenderness, pain, limitation, and occasionally abnormal movement with signs of extravasation of blood.

Treatment

As a sprain is a solution of continuity of soft tissue, just as a fracture is of bone, the treatment is essentially the same.

The joint should be kept at rest by strapping or splinting in a position which will relax the injured structures and permit union of the torn fibres. The rest and position should be maintained until Nature has had time to repair the lesion, from a week in minor cases, to six weeks in such severe lesions as sprain of the internal lateral ligament of the knee, with its probable complication of involvement of the medial memniscus.

If seen early, pressure as by bandaging will limit effusion and swelling. Cold applications will relieve pain. After the required period of fixation has elapsed, active movements and massage for the restoration of function must be undertaken. Alternate hot and cold baths are useful. Passive manipulation may be employed, but not beyond the range of painless movement. Measures to protect the healing tissues must be maintained until recovery is complete. Where practicable the nutrition of the muscles should be maintained by electrical stimulation or massage in the early stages when the joint is fixed.

Sprained Ankle

The lesion commonly involves one of the fasciculi of the external lateral ligament. To secure apposition of the torn structures, the foot must be everted and splinted in this position by adhesive strapping or Plaster of Paris.

Absolute rest is essential for a week or ten days, after which the patient may be allowed to get about again. The eversion must still be maintained by the use of a boot, the sole and heel of which is slightly thickened on the outer side.

Conversely, if the internal lateral ligament is damaged, the foot must be inverted and splinted in this position. Later, the newly united tissue must be protected by thickening the heel and sole of the boot on the inner side.

Sprains of Knee

Sprains of the knee are commonly the result of twists, and most frequently involve the internal lateral ligament.

This structure consists of fibres of varying lengths. The innermost are comparatively short, being fixed to the bones close to the articular lines, and also to the outer border of the internal semilunar cartilage. The outer fibres are much larger and are attached to the bones at some distance from the articular surfaces.

The inner fibres give way first and the semilunar cartilage is frequently involved. Most commonly the anterior attachment is torn, but the injury sometimes includes both anterior and posterior attachments. The cartilage may be torn across the middle, or split longitudinally.

When the internal lateral ligament is torn, the strain is next thrown on the crucial ligaments, which may rupture, or the tibial spine may be broken off.

Such severe lesions are accompanied by extensive haemorrhage into the joint. The slighter injuries are frequently followed by a simple serous effusion into the joint.

In the slight cases, a short period of rest and splinting will effect a cure, but in the more severe injuries at least six weeks of absolute rest is essential.

Effusion should be treated by pressure, and in some cases by aspiration. Haemorrhage increases the possibility of adhesions. A plaster splint extending from the upper part of the thigh to the ankle gives excellent fixation. When the splint is removed, general measures for restoring function of the joint must be carried out. The injured ligament must be protected from strain by thickening the inner aspect of the sole and heel of the boot.

Sprain of Wrist

For sprain of the wrist, rest in the dorsi-flexed position of the hand and subsequent massage are alone required. Radiography has shown, however, that such conditions are often associated with fracture or dislocation of a carpal bone. Occasionally a painful weakness follows from non-union of fragments, or an unreduced dislocation, and the removal of the fragment will be necessary.

Sprains of the Spine are common accidents, and most frequently affect the cervical and lumbar regions.

In the simpler cases, damage is confined to the external muscles and ligaments, and a short period of rest in bed, followed by massage, will suffice to cure.

In severe injuries, the ligamenta subflava are torn, the spinal canal is opened, and pressure from haemorrhage may lead to a temporary or permanent paraplegia. A prolonged period of rest in bed is essential. Subsequent support by spinal brace or plaster may be needed in severe types.

Just Published!

A Guide to the Poisonous Plants and Weed Seeds of Canada and the Northern United States

By Prof. R. B. THOMSON and Prof. H. B. SIFTON
of the University of Toronto

THE subject matter in this book is admirably arranged under separate sections and different headings. There are forty full-page illustrations enabling the easy identification of the various harmful agents, such as Water Hemlock, Poison Ivy, Etc.

This book will be sent postpaid to any address for **$2.50** *by the publishers*

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Professor V. E. Henderson
Medical Building
University of Toronto

University of Toronto

MEDICAL BULLETIN

PUBLISHED BY THE FACULTY OF MEDICINE

VOL. III, No. 1 NOVEMBER, 1922

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FREDERICK F. TISDALL

Sub-Department of Paediatrics
University of Toronto

UNIVERSITY OF TORONTO PRESS

SPECIAL GRADUATE COURSES

The Faculty of Medicine announces that the following Special Graduate Courses will be given from January 2nd to January 6th, 1923.

The fee for each course will be $10.00, payable on registration. Applications will be received by the Secretary of the Faculty until December 16th, 1922. As the courses will not be conducted unless the minimum number stated apply, applications should be made before this date.

1.—*Medicine* (at least 10 and not more than 20).

The following will be dealt with:

(1) Diseases of the Cardio Vascular System.
(2) Diseases of the Respiratory System.
(3) Diseases of the Nervous System.
(4) Diagnosis and Treatment of the Commoner Skin Infections.

The course will be limited to a class of twenty, and shall consist mainly of bed-side and theatre clinics. Members of the profession attending the course will be able to attend clinics in the above four subjects.

2. *Surgery* (at least 10 and not more than 20).

The following will be dealt with:

(1) Head.....Injuries—Fracture of Skull
Chest.....Empyema
Abdomen.....Acute Abdominal Conditions
G.U.....Cystitis—Haematuria
Extremities.....Fractures—Diagnosis, X-ray interpretation, Treatment—operative and non-operative
(2) Surgical Condition of Joints
Classification, Diagnosis, Pathology, Treatment
(3) Sprains..... Differential diagnosis, Treatment
(4) Infections in the hand—Treatment

The course in Surgery is intended largely to cover the questions of diagnosis of surgical conditions, and the treatment of emergency conditions. It is designed to meet the needs of the general practitioner.

3. *Obstetrics and Gynaecology* (at least 6 and not more than 10).

The following will be dealt with:

(1) Antenatal care, including clinical pelvimetry and diagnosis by abdominal palpation.
(2) Toxaemias of Pregnancy.
(3) Uterine Haemorrhage.

(4) Late repair of obstetrical injuries and correction of displacements—disturbed pelvic mechanics.
(5) Pelvic Inflammation.
(6) Demonstrations in Gynaecological Pathology.

SHORT COURSES IN RADIOLOGY

In order to meet the needs of those graduates in Medicine who desire short courses of instruction in Radiology, it has been arranged to provide three courses a year of one month each at the Toronto General Hospital. Classes will be limited and an intensive schedule has been outlined to include:

(*a*) Radiographic Technique.
(*b*) Interpretation.
(*c*) Gastro-Intestinal Examination.

In these courses the entire resources of this large clinic will be placed at the disposal of the student in the most practical manner possible.

The dates are as follows:

Month of January, 1923.
Month of May, 1923.
Month of October, 1923.

For full information and terms apply to the Secretary of the Faculty of Medicine, University of Toronto.

EDITORIAL

IN publishing the MEDICAL BULLETIN, the Faculty have endeavoured to present to the practitioners in the Province of Ontario, articles on recent advances in the science and art of Medicine of such a character that the practitioner will not only become acquainted with new developments, but will also receive ideas and suggestions which they can immediately put into use in their daily practice. The methods by which the Nausea and Vomiting of Pregnancy may be scientifically alleviated were described in detail. The importance of breast-feeding the baby and the ways of improving the secretion of milk were also dealt with. Another article outlined the treatment of Auricular Fibrillation. The difficulty of relieving the pain and suffering from chronic arthritis formed the basis of another paper and showed how it was possible to relieve some of these cases by the control of the sugar intake in their diet. "Infections of the tendon Sheaths" and "Sprains" contained practical suggestions of value to the practitioner.

In this number another article of the same type is published. Dr. Tisdall has given a simple and substantially correct account of a very difficult subject and has clearly indicated how treatment may be applied, in a succinct and useful paper.

CHANGES IN THE FACULTY OF MEDICINE

Not for some years have so many changes occurred in the Faculty of Medicine as have taken place this year. Death has removed two of the oldest and most respected, in the persons of Professor J. J. Mackenzie and Professor G. A. Bingham. They were both well beloved by their confreres and their students.

On the appointment of Professor B. P. Watson to a chair in his Alma Mater at Edinburgh, his resignation from the Professorship of Obstetrics and Gynaecology was received. Dr. W. B. Hendry, who was made an Associate Professor in this Department on his return from war service, was promoted to the Head of the Department.

Professor D. J. G. Wishart, who came into the Faculty on the amalgamation with Trinity University, retired from the Head of Oto-Laryngology, on having attained the age limit of the University, his place being taken by Dr. Perry G. Goldsmith.

Promotions to Professorial rank were made in the various departments as follows:

Medicine

Dr. J. A. Oille.....Assistant Professor of Medicine.
Dr. G. W. Howland.....Assistant Professor in charge of Neurology.
Dr. D. K. Smith.....Assistant Professor in charge of Dermatology.

Surgery

Dr. W. E. Gallie.....Assistant Professor of Clinical Surgery.
Dt. W. W. Jones.....Assistant Professor of Clinical Surgery.

Obstetrics and Gynaecology

Dr. F. A. Cleland....Assistant Professor of Obstetrics and Gynaecology.

Ophthalmology

Dr. D. N. Maclennan.....Assistant Professor of Ophthalmology.
Dr. W. H. Lowry.....Assistant Professor of Ophthalmology.

THE MEDICAL ALUMNI ASSOCIATION

The graduates in Medicine of the University of Toronto (including Trinity, Victoria and the Toronto School of Medicine) held a most successful meeting in Toronto on November 7th. Details of organization were completed and an agreement with the Alumni Federation confirmed. The meeting was a large and well attended one, many men from distant places being present. The President, Dr. H. B. Anderson, gave an inspiring introductory address, outlining the numerous ways in which the Association might be of interest and value to both graduates and their Alma Mater. Hope was expressed that the enthusiasm with which this organization of medical graduates was begun, would persist and

thrive and thereby lead to the development of much closer bonds between the University and its graduates.

The officers for this year are as follows:

Honorary President

Alex Taylor, Goderich.

President

H. B. Anderson, Toronto.

Vice-Presidents

T. H. Middleboro, Owen Sound; J. F. R. Forster, Stratford; G. W. Badgerow, London, Eng.; T. H. Bell, Winnipeg; H. J. Way, Chicago; Thos. McCrae, Philadelphia; H. B. Moffatt, Ottawa; R. T. Noble, Toronto; G. Stewart Cameron, Peterborough.

Secretary-Treasurer

Harley Smith, Toronto.

Executive Committee

Beaumont Cornell, Brockville.; A. S. Tilley, Bowmanville; J. Sheahan, St. Catharines; J. H. Duncan, Sault Ste. Marie; C. E. Spence, Fort William; Herbert A. Bruce, Toronto; E. Stanley Ryerson, Toronto; W. H. Harris, Toronto; O. Sisley, Toronto; F. C. Harrison, Toronto.

ACIDOSIS IN CHILDREN

Frederick F. Tisdall

Sub-Department of Paediatrics
University of Toronto

In children two groups of cases are encountered in which acidosis may be a prominent feature. The first consists of certain cases of diarrhoea; the second of such conditions as recurrent vomiting, partial or complete starvation (from any cause) and diabetes.

Not all infants with diarrhoea have acidosis, in fact it is the exception rather than the rule. It occurs most frequently in poorly nourished infants with severe diarrhoea who have had recent gastro-intestinal disturbances. The only definite clinical evidence of the condition is hyperpnoea or air-hunger. The respirations are deep and laboured with the rate only slightly increased. The skin is loose showing evidence of loss of water from the body. Pallor may be present, but cyanosis is extremely unusual. The patient gives the impression of being in a state of fright and tosses about with the eyes sunken and staring. This state may alternate with one of stupor or semi-consciousness. The clinical picture presented by patients in which the acidosis is an accompaniment of recurrent vomiting, starvation or diabetes is essentially the same except that the evidence of excessive water loss from the body is not present.

In order to understand the rationale of the treatment which will be outlined it is necessary to have some conception of the mechanism by which the reaction of the blood is maintained at a constant level in spite of the normal large pro-

duction of acid by the body. An effort has been made to do this in as simple a manner as possible.

The slightly alkaline reaction of the blood is largely determined by the presence in it of sodium bicarbonate and carbonic acid in definite proportions. Sodium bicarbonate ($NaHCO_3$) is a weak alkali while carbonic acid (H_2CO_3) is a weak acid. When these two substances are present in a solution in the proportion of one part of carbonic acid to twenty parts of sodium bicarbonate the reaction is on the alkaline side of neutrality and just that of blood. Large amounts of acid may be added without perceptibly changing the reaction. Thus if hydrochloric acid (HCl) is added the following occurs—$NaHCO_3$ HCl = NaCl H_2CO_3. In other words the hydrochloric acid reacts with the sodium bicarbonate to form a neutral salt (NaCl) and carbonic acid (H_2CO_3). This means that HCl, one of the strongest acids has been replaced by H_2CO_3, one of the weakest acids. This ability to change strong acids to weak acids is known as "buffer action". There are also at least two other groups of substances in the blood which have this "buffer action" and assist in maintaining its alkalinity. These substances are the acid and alkaline phosphates (NaH_2PO_4 and Na_2HPO_4) and the proteins of the blood. A discussion of their effect, which is for our purpose essentially the same as that of bicarbonate, will be omitted in this paper.

For the maintenance of the constant alkaline reaction of the blood it is necessary that carbonic acid and sodium bicarbonate be present in the proportion of 1 part of the former to 20 parts of the latter. A change toward acidity might be produced in two ways: first by disturbing the ratio through an increase of the amount of carbonic acid, and second by disturbing the ratio through a decrease in the amount of sodium bicarbonate. The first phenomenon normally occurs with any increased exertion but the excess of carbonic acid is immediately removed through the lungs by increased ventilation. The carbonic acid is not removed as such but as carbon dioxide leaving water behind ($H_2CO_3 = H_2O\ CO_2$). The amount of CO_2 in the alveolar air tends to be in equilibrium with the carbonic acid present in the blood. The second method of altering the reaction of the blood is by a reduction of the amount of bicarbonate, and this is what occurs in acidosis.

It is necessary before proceeding further to understand what is meant by the term "acidosis". One would naturally think that it means an increase in the acidity of the blood but profound disturbances in the functions of the body and even death may result from minor changes in the reaction. The mere presence of abnormal acids as shown by acetone on the breath or acetone, oxybutyric and diacetic acid in the urine does not in itself constitute an acidosis. What is then meant by the term acidosis? It simply means a diminution in the concentration of sodium bicarbonate in the blood.

If the sodium bicarbonate is reduced in acidosis why then does not the blood become more acid? As already mentioned carbonic acid and sodium bicarbonate at the normal reaction of the blood are present in the proportion of 1 to 20. For illustration we may assume that there are normally present 3 parts of carbonic acid and 60 parts of sodium bicarbonate. If the bicarbonate was reduced from 60 to 40 the ratio of 1 to 20 would be disturbed and the blood become more

acid. But when this occurs the body immediately reduces the carbonic acid to 2 parts and thus maintains the normal ratio. This is accomplished by deeper and more rapid respirations (hyperpnoea or air-hunger) which lowers the concentration of carbon dioxide in the alveolar air and in turn the carbonic acid in the blood. The reaction of the blood becomes more acid only when the reduction in the bicarbonate is so marked that the body is not able to produce a corresponding reduction in the carbonic acid. This only occurs in the terminal stages of an acidosis and is not compatible with life.

The exact cause of the reduction of the blood sodium bicarbonate (acidosis) in the diarrhoeal type of case is not known. From work in progress in this department there is some evidence that it may be due to a reduction of the sodium in the blood so that there is not enough available to form the necessary amount of sodium bicarbonate.

The acidosis which is present in recurrent vomiting, starvation or diabetes is the result of excessive formation of the ketone acids (beta-oxybutyric acid and diacetic acid). The only definite clinical sign of the acidosis is hyperpnoea. At this point it might be well again to stress the vital importance of bearing in mind that the mere presence of acetone on the breath or acetone and the ketone acids in the urine does not constitute an acidosis unless they are present in sufficient quantity to cause a reduction of the sodium bicarbonate.

The abnormal production of the ketone acids reduces the sodium bicarbonate in the following manner. There is an accumulation in the blood of a large amount of sodium oxybutyrate and sodium diacetate. The sodium used to form these salts from beta-oxybutyric acid and diacetic acid is obtained from the sodium originally present as sodium bicarbonate. Obviously as the ketone salts increase the amount of sodium bicarbonate decreases, while the total amount of sodium in the blood remains stationary. The complete proof of this theory has recently been published.

Treatment—The treatment of acidosis due to the abnormal production of ketone acids (with the exception of cases of diabetes) is the administration of glucose. Ketone acids are produced by the incomplete oxidation of fat and when carbohydrate is supplied in sufficient amount the fats and the ketone acids are completely oxidized to carbon dioxide. Thus the administration of glucose prevents the further formation of these acids and allows the sodium combined with them to reform sodium bicarbonate and the acidosis is cured. On account of vomiting which is usually present the glucose cannot be given by mouth and consequently should be given subcutaneously or intravenously. The strength of the solution, which of course must be sterile, should be 5 per cent. and the amount given 150 to 250 cubic centimetres. This may be repeated in two or three hours. The reaction is usually very prompt. No harmful effects have been seen from the daily subcutaneous administration of this amount of glucose even over a period of one or two weeks.

The treatment of the acidosis present with diarrhoea is, on theoretical grounds, the administration of sodium bicarbonate. Although this rapidly cures the acidosis the patients almost invariably die. The treatment which gives more satisfactory results is again the administration of glucose. This apparently acts by increasing the general resistance of the child and possibly by stimulating

the liver so that it is better able to detoxicate the various poisons absorbed. The amount of glucose given and the method of administration are the same as outlined in the preceding paragraph. If the patient survives the acute stages, this treatment may be continued with great advantage for several days after the acidosis has disappeared. The exsanguination-transfusion method developed by Dr. Bruce Robertson is a life-saving procedure in urgent cases and should be combined with the above treatment.

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UNIVERSITY OF TORONTO PRESS

GRADUATE COURSE IN PAEDIATRICS.

JULY 2ND—28TH.

In post graduate instruction it is the aim of the Staff in Paediatrics to teach fundamental principles as much as possible illustrating common everyday occurrences in general practice. The showing of unusual cases, which are only of academic interest, is avoided.

The bedside teaching consists of the routine methods of diagnosis, general management and treatment of feeding defects, deficiency diseases, acute intestinal diseases, breast feeding technique, acute respiratory diseases, conditions arising following focal infection, such as heart disease, laying special emphasis on prophylactic measures.

The teaching in the Out Patient Department is devoted to the diagnosis and treatment of the simpler conditions arising in childhood such as otitis media, bronchitis and common feeding disturbances.

Applications will be received for the above course by the Secretary of the Faculty of Medicine, up to June 15th, 1923. The fee for the course is $50.00.

SHORT COURSES IN RADIOLOGY.

In order to meet the needs of those graduates in Medicine who desire short courses of instruction in Radiology, it has been arranged to provide three courses a year of one month each at the Toronto General Hospital. Classes will be limited and an intensive schedule has been outlined to include:

(*a*) Radiographic Technique.

(*b*) Interpretation.

(*c*) Gastro-Intestinal Examination.

In these courses the entire resources of this large clinic will be placed at the disposal of the student in the most practical manner possible.

The dates are as follows:

Month of May, 1923.

Month of October, 1923.

For full information and terms apply to the Secretary of the Faculty of Medicine, University of Toronto.

EDITORIAL.

We present in this issue a discussion of the treatment of diabetes with a carefully considered statement of the advantages to be achieved by the use of insulin by the Professor of Medicine and head of the Diabetic Clinic of the Toronto General Hospital. This article is particularly timely in view of the short courses dealing with the use of insulin to be given by the University on an arrangement with the Ontario Medical Association.

Great and deserved credit for the discovery of insulin has been given to Dr. F. G. Banting, a graduate of the University of Toronto, 1917, who served overseas with distinction. His was the idea that led to the isolation in a more or less pure form of the internal principle of the islands of Langerhaus. To Professor J. J. R. Macleod also is due great credit for recognizing that Banting's idea might lead to success and placing at his disposal the necessary facilities for the work and to Mr. C. H. Best is due credit for the painstaking enthusiasm with which he devoted himself to the undertaking, and especially for the present commercial preparation of the extract in the Connaught Laboratories of the University. Professor Collip first obtained an extract pure enough to administer repeatedly to patients. His method has been greatly improved by the work of Messrs. Best, Maloney and Scott in Toronto, and by workers in the United States. Professor Macleod, with Dr. Hepburn, Mr. E. C. Noble and Dr. J. Latchford, in addition to Banting and Best did further important researches on the mechanism of the action of insulin and its standardization. The original source of insulin from a degenerated gland was not a commercial one. Banting knew that diabetes mellitus in woman remitted in pregnancy, and therefore obtained from the slaughter house foetal glands, and he and Best obtained from them potent extracts. Then they were successful in obtaining it from the whole beef gland. While successful in their initial attempt it required many weeks to repeat this success and to so control the many factors involved as to obtain it in commercial quantities required long and arduous work. Fortunately this has been achieved and another boon is placed at the service of physicians and their patients.

The readers of The Bulletin will join with the University in congratulations to Professor J. J. R. Macleod, Professor of Physiology in his being made a Fellow of the Royal Society. This high honour is a well deserved tribute to the many contributions to his subject, made by him and his associates.

THE NEW PROFESSOR OF PATHOLOGY.

The Faculty of Medicine have been fortunate in securing Dr. Oskar Klotz to succeed the late Professor J. J. Mackenzie as Professor of Pathology and Bacteriology. Dr. Klotz is a native of Preston, Ontario, and received the degree of M.B., in 1902 from the University of Toronto. From 1905 to 1910 he was at McGill University in the Pathological Department with Professor J. G. Adami, and at the Royal Victoria Hospital as Assistant Pathologist. Since 1910 he has held the position of Professor of Pathology and Bacteriology at the University of Pittsburgh. For the past two years he has been on a special mission for the Rockefeller Foundation in South America. Many contributions to medical literature have been made by him, the subjects of some of these bearing on the various diseases of the blood vessels, kidney, liver, bones and lungs..

Dr. Klotz is a member of a large number of the scientific medical associations on this continent, having at one time been President of the Association of Pathologists and Bacteriologists.

A very warm welcome awaits Dr. Klotz at his Alma Mater from many of his old friends when he assumes his duties on the first of July, 1923.

VISITING GRADUATES.

Graduates in Medicine of the University of Toronto and of other Universities are always welcome to visit the hospitals and laboratories, where the work of the Medical Faculty is being conducted. The organization of the Faculty is now such that arrangements can be made for visiting physicians to become acquainted either with the general features, which characterize the medical course, or with the particular ones of any of the departments. If a visitor is desirous of discussing the former, he should get in touch with the Dean or the

Associate Dean; if he is anxious to see the work in any department, the Head of that Department will direct him as to the best manner in which he can attain his objective. The secretary's office in the Medical Building is open from 9 to 5 daily, and will supply any general information that might be of assistance.

The Pathological Museum in the basement of the Pathological Building is being completely reorganized. Many new and interesting specimens have been added. Physicians will find that a visit to this will provide them with examples of many of the common lesions which they meet in their daily practice.

If a physician is planning to come to Toronto, a line to the Secretary of the Faculty saying in what he is especially interested, would enable arrangements to be made for him in anticipation of his visit. Address and telephone numbers of the Dean and Heads of Departments may be obtained at the Secretary's Office, Medical Building.

EXTENSION LECTURES.

Extension lectures by members of the staff, are arranged for in Ontario through the local and provincial Medical Association. If Medical Societies in the West or other parts of Canada wish to make arrangements to have one of the members of the Faculty lecture on some particular subject, every effort will be made by the Faculty to comply with any such requests.

DIABETES MELLITUS AND INSULIN.

DUNCAN GRAHAM, M.B.
(*Department of Medicine.*)

Carbohydrate, such as the starches, taken in the food, is converted during digestion into simple sugars, such as glucose. In this form it is absorbed by the intestine and carried by the blood stream to the liver, where most of it is stored as glycogen. As the tissues of the body require more carbohydrate, glycogen is transformed into blood glucose in sufficient quantity to meet the demand. In diabetes mellitus the sugar absorbed from the intestine is no longer stored in the liver as glycogen, but circulates in increased quantities in the

blood, is excreted in the urine, and becomes lost to the body as a source of energy. As a result the store of glycogen is rapidly exhausted and protein is attacked as a source for glucose. Further, as carbohydrate is necessary for the normal metabolism of fat in the body, incomplete combustion of fat occurs in diabetes mellitus, resulting in diabetic acidosis and coma. Diabetes mellitus must, therefore, be considered as a disease of metabolism in which carbohydrate is not efficiently utilized by the body, thereby causing a derangement of the normal metabolism of proteins and fats as well as carbohydrates. This derangement of metabolism is recognized by the following clinical symptoms and signs—thirst, polyuria and a voracious appetite, hyperglycaemia (increase in the percentage of sugar in the blood), and glycosuria (sugar in the urine).

As a result of the experiments of Von Mering and Minkowski, in which they showed that extirpation of the pancreas in dogs was followed by persistent glycosuria and other symptoms of diabetes, the important relation between this gland and diabetes was established. The pancreas consists of two types of tissues—the acinar portion secreting the pancreatic juice (the external secretion) which reaches the intestine through the pancreatic duct, and groups of cells scattered throughout the gland, known as "the islands of Langerhans." These cells possess a rich supply of blood vessels. As the islands of Langerhans show patholigical changes of varying degree up to complete destruction in the majority of cases dying of diabetes mellitus, Opie and others have considered that the insular portion of the pancreas is the one related to diabetes mellitus. They believed that it probably furnished an internal secretion necessary to normal carbohydrate metabolism. It has remained for Banting, working in collaboration with Best in the Department of Physiology, under the direction of Professor Macleod, to determine the exact relationship of the pancreas to the disease diabetes mellitus.

It had been shown previously that, if the duct of the pancreas was ligated, degeneration occurred much more rapidly in the acinar portion than in the islands of Langerhans. Banting conceived the idea that, if an extract was prepared from the pancreatic tissue remaining some time after ligation of the ducts, it should contain the supposed internal secretion of the islands of Langerhans. In 1921 Banting and Best prepared an extract of the degenerated pancreas and injected it into diabetic dogs. Following the injection a definite lowering of

the blood sugar and a decrease in the amount of sugar excreted in the urine was found. They were able to show that, if sufficient extract was injected at proper intervals, completely depancreatised dogs could be kept alive and free of symptoms for a long period of time. These experiments proved that the islands of Langerhans in the pancreas contain a substance which lowers the blood sugar and diminishes or abolishes the excretion of sugar in the urine of diabetic dogs. Later, by extracting the pancreas with alcohol, they prepared an extract from the whole gland which contained the antidiabetic substance or hormone. This extract was injected subcutaneously into a boy suffering from severe diabetes mellitus. A definite lowering of the blood sugar and of the amount of sugar excreted in the urine resulted. Unfortunately the extract contained other substances which caused considerable local irritation, making repeated injection impossible. With the assistance of Collip an extract was prepared in a purer form suitable for repeated injection in man. This extract, containing the internal secretion of the pancreas, has been called "insulin."

Having found a method for the preparation of insulin in suitable form, it was now possible to test its value in the treatment of diabetes mellitus and study its effect on metabolism in both men and animals. The fundamental defect in diabetes is an inability on the part of the body to properly metabolize carbohydrates. Further investigation on the administration of insulin in diabetic dogs and in severe cases of diabetes mellitus have shown that the injection of insulin restores to the body the power to efficiently metabolize carbohydrates. Glycogen is again stored in the liver and, if insulin is given in sufficient quantity and at proper intervals, the blood sugar is maintained at a normal level and the urine remains free of sugar. Fat is completely burned. As a result of this, acetone bodies disappear from the urine and diabetic acidosis and coma are prevented. In brief, the artificial administration of insulin restores to the body a normal metabolism of carbohydrates, fats and proteins.

Although the administration of insulin is capable of relieving the cardinal symptoms and signs of diabetes mellitus, one must not conclude that insulin can replace the dietetic treatment of the disease. In diabetes there is a decreased production of insulin, due to the weakened function of the islands of Langerhans. As all cases of diabetes mellitus are capable

of metabolizing a certain amount of carbohydrate, the degree of damage to the islands and their capacity to produce insulin may be ascertained by estimating the tolerance of the patient for carbohydrate. The aetiological factor or factors causing this damage to the pancreas have not been discovered. It is known, however, that diets containing excessive quantities of carbohydrates, or proteins, fats and carbohydrates in improper proportions or quantities, as well as infections, further weaken the function of the already damaged pancreas. The object of treatment should be to give rest to the damaged islands and conserve their power to produce insulin. Before the introduction of insulin this was accomplished best by the dietetic treatment outlined by Allen and Joslin. By marked restriction in diet, combined with periods of fasting, Allen demonstrated that, even in severe cases of diabetes, the urine could be kept free of sugar and the blood sugar maintained at a normal level for long periods of time. Later, many patients remained aglycosuric without the necessity of fasting. This method of treatment gave a maximum of rest to the damaged pancreas and allowed it to maintain, or even increase its power to produce insulin. The lives of severe cases of diabetes were definitely prolonged; whereas mild cases regained sufficient tolerance for carbohydrates to allow them to take a more liberal diet and yet remain free of symptoms. Unfortunately the extreme under-nutrition resulting from the prolonged use of the restricted diet with fasting caused a marked loss of weight and strength, and made the continuation of the treatment difficult.

The introduction of insulin in the therapy of diabetes makes it possible to begin the treatment of even severe cases with a palatable diet of protein, fat and carbohydrate in adequate quantities to meet the requirement of the body at rest in bed or with moderate exercise, and at the same time afford adequate rest to the damaged islands of Langerhans. After the glycosuria and ketonuria have disappeared and the blood sugar level returned to normal, the diet may be gradually raised until the patient is receiving sufficient food to maintain the body weight slightly below normal, and sufficient calories for the body to perform the ordinary duties of life. In some cases the pancreas has so regained its power to produce insulin that the daily dosage need not be increased; in others, where the damage to the pancreas is more permanent, suffici-

ent additional insulin must be given to keep the urine of the patient free of sugar on the increased diet.

Overdosage of insulin is followed by the development of serious signs and symptoms demanding immediate treatment. The patient complains of a sense of weakness and fatigue associated with sweating, a feeling of tremulousness and sometimes pallor and flushing. In the more severe forms there is acute distress with mental disturbances and even unconsciousness. These reactions are due to a fall in the blood sugar below the normal level of .1 per cent. When the blood sugar falls to .07 per cent. symptoms develop, and if it falls to .035 per cent. the patient becomes unconscious. The symptoms, though alarming both to the patient and those in attendance, are completely relieved if glucose is given immediately.

The indiscriminate use of insulin in the treatment of diabetes mellitus is a real source of danger. At the beginning of the treatment all cases of diabetes mellitus, except those suffering from severe acidosis and coma, should be put to bed and given a basal maintenance diet. This diet contains protein sufficient to replace the daily wear and tear of the tissues of the body, approximately .3 gm. per pound of body weight. Additional calories in the food are supplied by carbohydrate and fat in proper proportion to prevent the production of acetone bodies and in adequate amount for the height, weight and sex of the patient. If the urine of the patient becomes free of sugar on this diet it should be gradually raised until he is receiving an adequate diet for the performance of the ordinary duties of life. Should the patient remain aglycosuric on this diet insulin treatment is not indicated. Approximately seventy-five per cent. of diabetics may be controlled by dietetic treatment.

If, at the end of a week's treatment on a basal diet, the urine is not free of sugar the patient requires insulin. The amount of insulin to be injected daily is dependent upon the total amount of glucose found in the urine at the end of the preliminary period of observation. It is given in divided doses, injected subcutaneously, usually before breakfast and supper or, in more severe cases, before each meal. Under combined dietetic and insulin treatment the patient rapidly improves. As the body is supplied with an adequate amount of insulin carbohydrate is properly metabolized—sugar and acetone bodies disappear from the urine and the blood sugar returns to a normal level. The patient enjoys his food, feels

stronger, and the mental depression so characteristic of the severe diabetic is replaced by cheerfulness. Some patients have been able to resume their former occupations after a month's treatment.

Probably the most brilliant results obtained with insulin have been in the treatment of diabetic acidosis and coma. In the treatment of these cases insulin must be given immediately. All cases of acidosis and threatened coma react favourably to combined dietetic and insulin treatment. In uncomplicated cases of advanced coma the majority—four out of six—have recovered after being given repeated intravenous injections of insulin combined with an adequate amount of glucose to prevent the blood sugar from falling to a dangerous level. All the other fatal cases of coma treated had an associated infection sufficiently severe to cause death apart from the diabetic condition. Although the results obtained in the treatment of advanced coma with insulin have not been so uniformly satisfactory as in other stages of the disease, one should remember in this connection how hopeless the treatment of this condition was under the former methods of treatment.

The susceptibility of the diabetic to infection has long been recognized. The effect of a developing infection or a surgical operation upon the future course of a case of diabetes was feared by the physician. These, combined with acidosis and coma, constituted danger points in the life of the diabetic. If infection develops, or an operation becomes necessary in a case of diabetes adequately controlled by diet, sufficient insulin should be given to keep the urine free of sugar and acetone until the patient recovers. In more severe cases of diabetes already under insulin treatment the daily dose must be increased. Under combined dietetic and insulin treatment diabetics have recovered from mild infections in a normal period of time; teeth have been extracted, tonsils removed, and amputations performed with safety.

Diabetes mellitus can be successfully treated in the less severe form by giving a properly balanced diet; in the more severe, by proper diet and an adequate daily dosage of insulin. The success of treatment is dependent upon the physician for the institution of proper treatment, upon the patient for the continuation of the treatment prescribed. A prescription of a properly balanced diet is of as much, or even greater importance for a case of diabetes mellitus than is one of drugs

in the majority of the diseases the physician is called upon to treat. In the beginning of treatment the value to the patient of a month or six weeks' stay in an institution with proper facilities for the investigation and dietetic control of cases of diabetes mellitus cannot be overestimated. The case can be more fully investigated and the effect of an accurate diet carefully controlled. The patient appreciates more readily the value of proper diet in the treatment of his condition, and becomes familiar with the character, amount and preparation of the various food-stuffs constituting his diet. In an institution the tuberculous patient learns how to live; the diabetic what to eat.

The following is a list of publications on "Insulin":

Banting and Best: The Internal Secretion of the Pancreas. Journ. Lab. and Clin. Medicine, 1922, VII, 261.

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Banting, Best, Collip, Campbell and Fletcher: Pancreatic Extracts in the Treatment of Diabetes Mellitus. Can. Med. Ass'n. Journ., March, 1922.

Banting, Best, Collip, Macleod and Noble: Preliminary Studies on the Physiological Effects of Insulin. Trans. Royal Society of Canada, 1922, XVI.

Banting, Best, Collip, Macleod and Noble: Effects of Pancreatic Extract (Insulin) on Normal Rabbits. Amer. Journ. Physiol., 1922, LXII, 162.

Hepburn and Latchford: Effect of Insulin (Pancreatic Extract) on Sugar Consumption of Isolated Surviving Rabbit Heart. Amer. Journ. Physiol., 1922, LXII, 177.

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Banting, Campbell and Fletcher: Further Clinical Experience with Insulin in the Treatment of Diabetes Mellitus. Brit. Med. Journ., Jan., 1923.

Banting, Campbell and Fletcher: Insulin in the Treatment of Diabetes Mellitus. Journ. Metabolic Research, April, 1923.

Campbell, W. R.: Ketosis, Acidosis and Coma Treated by Insulin. Journ. Metabolic Research, April, 1923.

Fletcher and Campbell: The Blood Sugar Following Insulin Administration and the Symptom Complex—"Hypoglycaemia." Journ. Metabolic Research, April, 1923.

FLAT FOOT.

CLARENCE L. STARR.

(*Department of Surgery.*)

Any affection of the foot which interferes with comfortable function in whole or in part, is a serious disability to the average individual. Aside from injuries to the feet, the bare footed peoples of the world, and to a proportional extent the sandal and mocassin wearing peoples, are free from the great

majority of the disabilities found among so-called civilized peoples. This suggests that the modern clothing of the feet is responsible for the bulk of foot trouble as seen in the daily contact with patients complaining of disabilities so great as to interfere with comfortable function. It is also responsible for a diminution in function to a greater or less extent in the army of non-complaining individuals, some of whom do not know what foot comfort is. The absence of foot constriction and the active life of these bare footed peoples encourage a muscle development of leg and foot which is also a factor in maintaining good function, and is not seen in wearers of modern boots. The luxurious tendency of the age, with the advent of the automobile and other methods of transportation, tempts most individuals to ride where they might better walk, thus lessening their muscular development and increasing the bulk weight to be carried, and thereby other factors are added which are certainly responsible for loss of function. The development of the muscles of the foot and leg is possible to a wonderful degree by the active use of the feet, as in climbing and similar exercises, excellent examples of which are seen in some of the bare footed races. That this development is possible in modern civilization is shown by the few cases of congenital absence of the hands, or similar defects, in children, which makes imperative the early use of the foot as a substitute for the hand. These children have so developed the muscles of the feet that knitting, writing and fine sewing and wonderful dexterity generally are possible.

A study of the advertisements of the modern boots, especially those designed for women, will show at a glance that all attempts to clothe the foot comfortably have been abandoned in most cases. For not by the wildest stretch of the imagination can one feel that the modern boot has the slightest resemblance to the normal or undistorted foot. Until the public can be educated to the wisdom, from an economic standpoint as well as from the standpoint of comfort, of starting the child with a properly shod foot and following this into the periods of adolescence and manhood and womanhood, so long will our generation continue to suffer from distortions and disabilities with the consequent loss of economic usefulness. It is argued that designers and manufacturers do not make the proper sort of footwear, and therefore the public are compelled to buy what is manufactured. The answer is, that the manufacturers and retailers make and stock what

the public demands, and if the public demands a proper shoe, and will buy no other, the manufacturers will soon supply it. The worst defects in shoes are the high heels with narrow weight-bearing base, and the narrow-pointed toes, especially if pointed in the middle of the boot. The essentials of a good boot are a straight inside, a square flat heel, and a sole wide enough at the ball to permit toe movement.

While a fairly large percentage of the cases of disability of the feet is due to flat foot, it is by no means the only condition existing, and yet in a great many instances as soon as a patient complains of the feet a diagnosis of "fallen arches" or flat foot is made on a most casual examination. The next procedure is to order, or permit the ordering of flat foot plates. A general statement may be made that for the most part these plates are useless for the purpose for which they are intended, and in a great many cases they are harmful.

Etiology.—In addition to faulty shoes there are three factors which predispose to the production of flat feet.

1. Excessive or faulty use, or both. Many individuals with ordinarily good feet suffer foot strain and flat foot under unusual use. Nurses on long hours of duty on hard floors, policemen also on long hours of duty, bakers or butchers, who, in addition to being on their feet for long periods, often have to carry heavy weights, may all suffer from acute flat foot. Faulty use of the feet, especially in standing and walking, is also a predisposing factor. Most children are encouraged to turn their toes out when they walk. This habit is carried into later life and makes for a bad weight-bearing line—the centre of gravity falling over the scaphoid instead of being carried down the centre of the foot to the toes. Especial attention should be given to patients recovering from acute illness as they are likely to suffer severely from acute foot strain.

2. Overweight. Patients rapidly increasing their weight are apt to become flat footed when the foot structures usually carrying, say, 120 pounds, are called upon to carry an additional 40 or 50 pounds.

3. Defective muscular development. From faulty nutrition or lack of proper exercise the muscles are not strong enough to stand the strain, and the superincumbent weight falls on the ligaments. These soon stretch and flat foot results.

Symptoms and signs.—The flat foot has lost its normal contour, the inside of the foot is convex instead of concave from heel to ball. This is due to the abduction of the front

part of the foot from the midtarsal joint. The arch on the inner side of the foot thus disappears and this inner side comes in contact with the floor. Varying degrees of deformity may be present, from a very slight pronation to a complete flattening. The gait loses all its elasticity and the flat footed individual walks with toes turned out, bending the knees, and never getting a true heel and toe gait. The boots show the line of weight bearing, and wear off at the heel and sole on the inside edge, the shoes being "run over" toward the inside. The flexibility of the foot is lost to a greater or less extent, depending on the grade of the deformity, and may be so nearly lost as to produce a rigid foot. This rigidity is due to an accompanying arthritis, partly traumatic and partly toxic. It should be remembered that the faulty weight-bearing foot-producing strain on the tarsal articulations soon results in synovitis. The presence of infection in the tonsils, teeth, and so on, readily adds a toxic inflammation, and the feet lose motion from muscle spasm and adhesion of joint surfaces. Pain is a fairly constant factor. It is not necessarily greatest in the severest deformities. It is most acute in early stages of breaking down of ligaments and in cases where there is an added toxaemia, as every movement is painful. When the complete flattening has occurred, especially if associated with complete fusion and loss of motion, pain usually disappears.

Diagnosis.—The appearance of the foot and the gait of the individual, together with the story of faulty weight-bearing told by the boot, usually render a diagnosis easy. A print of the sole of the foot which has been smeared with lampblack will show how much of the plantar surface comes in contact with the floor as compared with the imprint of the normal foot. If the contour of the foot is normal, the arch well up, the inside of the foot concave, the weight-bearing line true and the foot flexible, a diagnosis of flat foot is not justifiable, and some other cause of pain and disability must be sought.

Treatment.—It should be possible by a process of education as to proper footwear, method of walking and standing, and general hygiene, to prevent this distressing malady in future generations, and efforts along this line should be made by the medical profession.

A study of each case should determine the course of treatment indicated in such case. In early or incipient cases, especially in young individuals, it may be sufficient to see that

they are properly shod and instructed in the way to walk with the feet parallel, so that a heel and toe gait is maintained. For a slightly more acute stage a wedge of 1-4 to 3-8 of an inch on the inside edge of the heel and sole may be added. These cases will also require muscular training of the weak muscles. Tip toe exercise with heels apart, lifting the inner side of the foot and rolling over on the outside edge, walking a crack with the centre of the foot placed accurately on the line one foot in front of the other, picking up small objects with the toes or standing on a raised surface with the toes over the edge, clawing the toes downward, and similar exercises, will develop the defective muscles and restore the balance of the foot. These exercises should be done a minimum number of times at first, and increased each day until the maximum is reached.

Overweight should be corrected by proper diet, exercises, and so on.

Supports should be used only when for some reason, such as heart defects, these exercises cannot be carried out. When a support is recommended it should be made of material sufficiently rigid that it will not flatten out under pressure of the weight to be carried. Most of the arch supports purchased are made of German silver, and can be flattened out easily, and in a week they are completely flat. The support should be made over a cast of the corrected foot, and should be high enough on the inside to support the scaphoid. It should also be short enough to permit heel and ball of the foot to rest on the sole of the boot. No support should be applied in a rigid foot until the arch can be restored by manipulation or strapping with adhesive plaster. The completely rigid non-painful flat foot is probably best treated by leaving it alone.

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UNIVERSITY OF TORONTO PRESS

EDITORIAL.

The Annual Educational Number of the British Medical Journal, September first, 1923, and the memorandum by Sir George Newman, Chief Medical Officer of the Ministry of Health of Great Britain, entitled "Recent Advances in Medical Education in England", reveal in the clearest terms the tremendous change which has come over medical education in Great Britain. The British student can now only proceed to his qualifying examination at the end of five years of study. Prior to entering upon these five years of study the student must have passed a recognized examination in general knowledge which is certainly equivalent to our Matriculation Examination; and, if taken at one of the larger Universities, would appear to be equal in severity to our requirement of Honour Matriculation in English, Mathematics and two other subjects. He must also have passed an examination in Chemistry, Physics and in Biology, after an additional year of study, which, if we may judge from Sir George Newman's report, requires a knowledge of these subjects equal to that given in the first year in the Medical Curriculum of the University of Toronto.

A British Medical Journal article in September 23, 1922, in commenting on the Medical course at Toronto, said:

"The difference in minimum duration of study is nominal and negligible, the subjects of Chemistry, Physics and Biology being part of the medical course, whereas in Great Britain, the first two of these subjects must in future be passed before Matriculation."

In the American system, in 78 out of 82 Class A medical schools, at least two years of study in an Arts College, including the subjects Chemistry, Physics and Biology, are required before entering upon the four years in Medicine, thereby making the total period of study six years, as in Toronto.

The inclusion of the work in Physics, Chemistry and Biology in the medical course at the University of Toronto is considered more advantageous than the American method, where it is given before the student begins the actual medical course. Another advantage

of the Toronto course over most of the United States Colleges is the provision of three years' study of the clinical subjects in contrast with their two years.

At Toronto a small percentage of the student's time is devoted to certain cultural Arts subjects. In commenting on the introduction of this idea into the medical course, an article in the British Medical Journal says:

"The University of Toronto plan is very interesting and very attractive. It aims at making its medical graduates not merely doctors but men of culture."

SUMMER ACTIVITIES OF THE STAFF

The Medical Faculty of the University have been especially honoured during the past summer by the number of occasions upon which its members have presented papers, given addresses or taken part in the discussion of important scientific organizations. Those attended by Profs. F. G. Banting and J. J. R. Macleod are referred to elsewhere.

Prof. J. P. McMurrich, Head of the Department of Anatomy, attended the meetings in Melbourne and Sydney, Australia, of the Pan Pacific Scientific Congress as the representative of the Fisheries Department of the Dominion Government, of the Advisory Council for Industrial and Scientific Research, of the Royal Society of Canada, as well as the University of Toronto. This Congress discusses the scientific problems bearing upon the Pacific Ocean and the neighbouring countries and formulates any plans for co-operative work.

The Dean, Professor A. Primrose, attended and addressed the 800th Anniversary of the St. Bartholomew's Hospital in London as the representative of Canada. The League of Nations Conference on the Standardization of Biological Products was attended by Prof. V. E. Henderson, Head of the Department of Pharmacology, and Prof. F. G. Banting. Papers were presented before the International Congress of Physiology at Edinburgh in July by Profs. J. J. R. Macleod, V. E. Henderson and F. G. Banting. Prof. H. A. Bruce was the Canadian delegate to the Congress of

the International Surgical Society; he also had the honour of an audience with the Prince of Wales. Prof. Duncan Graham attended the meetings of many of the above congresses and took an active part in their proceedings. Prof. H. B. Maitland, of the Department of Pathology, spent the summer in the Laboratories of Sir Almroth Wright.

NEW APPOINTMENTS

An important addition to the Faculty is the appointment as Assistant Professor of Anatomy of Dr. Eric A. Linell, who graduated from University of Manchester with the degrees of M.B., Ch.B., and later obtained his M.D. in 1920. In 1919-20 he held the "Leech" Research Fellowship in the University of Manchester, and in 1922-23 the "Tom Jones Research Fellowship". He also has occupied surgical positions on several of the hospitals in Manchester, the last one being that of Surgical Registrar at the Ancoats Hospital. The University is fortunate in getting a man who has had both scientific and clinical experience and anticipates that his knowledge will prove of value to the Faculty and to the students.

NOBEL PRIZE

The award of the Nobel Prize to Professors F. G. Banting and J. J. R. Macleod is one of the most signal honours that has ever been conferred upon members of the University Staff, and conveys with it one of the highest compliments the University has ever received. Only once before has the recipient of the prize in Medicine conducted his work in America, this being when Alexis Carrel of the Rockefeller Institute received it in 1912. Dr. Banting is not only the first Canadian, but as Carrel is by birth a Frenchman, also the first native of America to be so honoured. Although Professor Macleod has only been on our staff for five years, his interest and activity in the administration of the Medical Faculty have made him as well known as though he had been here many years.

The Nobel Prize was established in 1900, when nine million dollars was bequeathed by A. B. Nobel, the interest on which was to be given in five annual prizes for inventions in Physics, Chemistry, Medicine or Physiology, Idealistic Literature and services for peace.

In Medicine the award is made by the Karolinska Institute in Stockholm. Within six months of the award each recipient is supposed to lecture before the Institution which had the awarding of the prize. Of 85 recipients five have been Americans. The awards in Medicine 1901-22 are as follows: (1) Von Behring; (2) Ross; (3) Finsen; (4) Pawlow; (5) Koch; (6) Golgi; (7) Laveran; (8) Ehrlich & Metchnikoff; (9) Kocher; (10) Kossel; (11) Golstrand; (12) Carrel; (13) Richet; (14) Barany; (15) A. V. Hill & Meyerhof.

The very heartiest congratulations are extended to Professors Banting and Macleod for the glory and honour that their valuable work has brought upon the University of Toronto.

During the visit of Professor Banting to Great Britain last summer he gave papers and addresses before the International Congress of Physiology in Edinburgh, the triennial Congress of the International Surgical Society, and the Annual meeting of the British Medical Association at Portsmouth. On July 18th he was presented to His Majesty King George V. at Buckingham Palace.

At the International Congress on Physiology a paper was given on Insulin by Professor Macleod. He remained in Scotland for October at the invitation of the University of Edinburgh to deliver the Cameron lectures in Physiology.

PROLONGED FIRST-STAGE LABOUR.

William A. Scott.
(Department of Obstetrics and Gynaecology.)

A prolonged first stage labour is probably the most frequent cause of trouble and anxiety met with in obstetrical practice, and therefore should be a condition about which clear and definite

views are to be held. To discuss a "prolonged" first stage, however, postulates a knowledge of a normal first stage. We must remember that it varies in length through fairly long limits with an average of about sixteen hours in the primipara, and about twelve hours in the multipara. Patients vary markedly in their reactions to pain, some going through a long first stage with little evidence of suffering and others giving every indication of severe suffering almost from the first, thereby getting themselves, their relatives and even their physician into a much excited state long before the case is ready for any attempt at delivery. The proper management of prolonged first stage labours, therefore, includes the proper management of first stage labours that are not prolonged, but in which the patient, or more frequently, her relatives, are making some treatment apparently necessary.

A "rigid cervix" is the most frequently assigned cause of first stage delay. Any cervix is rigid and the proof is to attempt to manually dilate a cervix sufficiently to deliver a normal-sized child. If any result is obtained it is a torn cervix. A "spasm of the cervix" is also frequently mentioned in the etiology of this condition and the fact that the administration of a narcotic sometimes appears to hasten dilatation would make it seem that some such cause is occasionally present. A slowly dilating cervix is most frequently found, however, in occiput posterior positions. The insufficient flexion of the foetal head with failure to descend into the pelvis and the frequent early rupture of the membranes means that there is no dilating wedge, in addition to which the pains are liable to be weak and irregular, both in time and strength. Early rupture of the membranes in anterior positions is also apt to result in slow dilatation, as is hydramnios with a densely stretched bag of waters and a uterus under tension. In many cases none of these causes are apparent and one can simply say that the cause is unknown.

The treatment of these cases, I believe, consists of three parts: the treatment of the cervix, the treatment of the patient, and the treatment of her friends. There is one principle that is essential in the treatment of all difficult obstetrical cases and that is that under no circumstances must attempts at delivery be made until the cervix is fully dilated. This rule knows no exception and in

those exceedingly rare cases where delivery is necessary with an undilated cervix the only scientific procedure is a vaginal hysterotomy or an abdominal section. There is nothing more unscientific than to try with forceps to drag a head through a partially dilated cervix. As long as a rim of cervix can be felt it will probably cause trouble if an attempt is made to deliver a normal size child through it. Occasionally, especially in occipit posterior positions, one finds a cervix entirely dilated except for a small rim in front, which has become pushed down by the presenting part and caught between it and the pubes with the result that it soon becomes oedematous, congested and greatly increased in thickness. It is a simple matter to push such a bit of cervix over the presenting part during a pain. But what are we to do with a cervix that does not dilate after eighteen or twenty hours' labour? In the majority of cases the proper treatment is to control the patient and let nature manage the dilatation. If, however, the contractions are weak or irregular, one should try to increase their strength and frequency and pituitary extract in small doses, used carefully, is the best means of bringing this about. There are cases where one feels that the interests of the baby demand the hastening of dilatation and in such cases the simplest and surest method is the use of a hydostatic bag.

Finally, in cases of great emergency, where only a rim of hard cervix is left, crucial incisions may be employed but should be immediately repaired after delivery. One might, therefore, sum up the treatment of the cervix in this type of case as: (*a*) Watchful waiting in the vast majority of instances, (*b*) Occasionally the use of a bag, and (*c*) Crucial incisions or Caesarean Section in rare instances.

The second point in the treatment is the management of the patient. The great majority of these patients are never in any actual danger and it is only rarely that a prolonged first stage jeopardizes the well-being of the baby, so the problem resolves itself into one of controlling the pain and assisting the patient to have the mental fortitude to stand this tedious part of her labour. In the control of pain at this stage chloroform and ether are contraindicated. We have no way of knowing just how much longer the first stage is going to be and once a general anaesthetic is started

it is very difficult to cease giving it and allow the patient to go on unrelieved. These cases, however, are ideal ones for the use of morphine and hyoscine and these drugs may be employed in one of two ways. The patient may be given a sufficient dose to put her to sleep for some hours—ordinarily morphine grain ¼ and hyoscine grain 1/100 and at the end of two or three hours' sleep, one may be agreeably surprised to find not only a rested patient, but a cervix nearly or completely dilated. Or these same drugs may be used in a manner to induce a true "Twilight Sleep". If the latter course is followed it is essential to remember that each patient constitutes a specific problem and it is impossible to follow any dogmatic rule as regards the size of the dose or length of interval between doses. A satisfactory initial dose is morphine grain 1/6 and hyoscine hydrobromide gr. 1/150. The morphine is not repeated and the subsequent doses of hyoscine vary from 1/200 to 1/400 of a grain, the usual interval being about an hour. The patient, of course, must be kept absolutely quiet in a darkened room and under constant, skilled observation. By one or other of these methods it is possible to carry a patient through a very long first stage labour without danger and without any tremendous amount of suffering.

The third point in treatment is sometimes the most difficult, namely, the proper management of the patient's relatives. Not infrequently an obstetrician is forced, against his better judgment, into attempts at delivery through an incompletely dilated cervix by the importunities of anxious and excited relatives. There is only one answer. The obstetrician is armed with the knowledge that he is quite capable of dealing with this particular problem, and if relatives are causing him worry by the insistence that he "do something" he should see that they are kept out of the room and, if possible, out of the house. If they object or question his judgment it simply remains to have a colleague with equally good judgment in consultation to back up his course of action. The obstetrician was engaged to give this particular patient the proper treatment under all circumstances and her welfare is in his hands. His reputation will not suffer if he considers only her welfare and not her friends' misguided importunities.

THE TREATMENT OF COUGH.

V. E. Henderson.
(*Department of Pharmacology.*)

Cough is only a symptom and treatment should be directed to the cause. Frequently some palliative treatment directed to this symptom is of value.

Cough has its own causes, its own pathology. The trachea and bronchi, down to the smaller bronchioles, are lined with a ciliated epithelium through which emerge the ducts of many small mucous glands. These glands have the function of producing a mucous coat for the air passages which keeps the epithelium moist and collects dust and foreign matter. The mucus is slowly removed by the beating of the cilia which drives the mucus up to the vocal chords where the ciliated epithelium ends.

Cough is caused perhaps most frequently by either an inflammation of the vocal chords and larynx or the accumulation at this point of thick mucus brought from below. The next most frequent cause of cough seems to be due to an accumulation of mucus at the junction of two bronchi or bronchioles. Thirdly, cough is caused by a congestion of the mucous membrane of the bronchioles or bronchi without secretion, which closely resembles the congestion in the initial stage of a coryza. Fourthly, cough may be excited, or at all events aggravated, by irritation elsewhere in the area of the sensory vagus, *e.g.*, in the stomach.

To treat cough, a definite picture must be formed as to its cause and source in the particular case to be treated. We know how the dry itching discomfort of the early stage of a coryza disappears as secretion begins, that even a slight coat of secretion relieves the irritation.

Ipecacuanha, Antimony Tartrate, Ammonium Carbonate, are all known to irritate the stomach and set up sensory stimuli leading to efferent stimuli from the brain to the secretory glands of the mouth and respiratory tract. Their irritation is not very prolonged; they must be repeated at short, two-hour intervals, and doubtless the secretion they produce is not great in amount, but clinical observation and laboratory experiment alike have shown their utility.

An abundant secretion in the respiratory tract requires either constant cough or hawking to clear the larynx. Both tend to irritate its delicate mucosa if performed violently, and this is a matter of habit which the patient can often be got to regulate.

In the later stages of a bronchitis with a dry, thick secretion, in which the cilia move very imperfectly, great relief may be given by the exhibition of one of the above drugs or potassium iodide. This latter doubtless in part works reflexly from the stomach like the others mentioned, but it is excreted by mucous glands, for example, the submaxillary gland, and may tend, as some observers hold, to make the mucus less sticky and the cilia more active. Remember the secretion need not in this case be prolonged or great in amount, provided it lifts the drier secretion and sets free the cilia by giving them a suitable media in which to act.

After an attack of influenza or some other bronchitis, a dry cough, almost without sputum, often persists. It will usually be found that this is due to a little sputum in the larynx in the morning, which is viscid and only removed by much coughing, which in turn irritates the larynx and coughing persists all day. This is the ideal case for the exhibition of opium or morphine (Tinctura Camphorae Composita). The patient takes a hot drink, if possible, on awakening. He is ordered to stop coughing and the reason explained and is given a medicine which he is told will help him but which is only to be taken for two days, as he will by then be cured.

Should opium be combined with expectorants such as Ipecacuanha or Antimony? I believe not. Opium depresses the centres in the medulla; it thus decreases cough and also reflexly produced bronchial secretion. Ipecac and antimony, etc., work reflexly and opium interferes with their action. There may be a difference in the time taken to act, that is, the ipecac may act before the morphine is absorbed; but certainly, once morphine has acted, ipecac can have no effect. The morphine effect lasts three to four hours or more.

NERVE INJURIES IN WRIST WOUNDS.

ERIC A. LINELL.
(*Department of Anatomy.*)

Introductory

The frequency of wounds of the anterior aspect of the wrist-joint makes a consideration of some points in the surgical anatomy of this region a matter of considerable importance.

The cause of the wound is often a sharp cutting edge, such as the edge of a broken window-pane through which the hand has been thrust or the broken neck of a bottle, and such an instrument is capable of causing a deep wound in the structures anterior to the wrist-joint.

It is of immense importance to realize that the median and ulnar nerve-trunks may easily be injured in such a wound. If such a nerve-injury is missed or improperly dealt with the patient will be left with a severely crippled hand. The severed tendons may be beautifully sewn up but you will get no credit for a movable index-finger if the man discovers that, by missing an injured median nerve, you have left him with this very important member completely anaesthetic.

In the last year three cases of wrist wound have come under my notice as requiring further operative treatment some time after their wounds had been sutured in a hospital out-patient department. Two of these presented the physical signs of a median and the third showed those of an ulnar nerve injury.

At operation, which is often a matter of considerable technical difficulty, it was discovered that, in the two cases of median nerve injury, the proximal end of the severed nerve had been sutured to the distal end of one of the cut flexor tendons. In the third case the ulnar nerve injury had obviously been completely missed and the severed nerve ends were found separated by a considerable distance, the interval being filled by dense fibrous tissue through which it was obvious regeneration could never have occurred.

Here, then, were three hands, the function of which had been very seriously impaired owing, in the first two instances, to technical errors at the time of the preliminary operation and to an error of omission in examination in the third case.

Anatomy

The median nerve enters the hand through the carpal tunnel surrounded by the flexor tendons for one of which it can quite easily be mistaken even on the operating table. Its surface marking is the line of the palmaris longus tendon, if this is present. Otherwise a line drawn immediately mesial to the tendon of the flexor carpi radialis will give its position and direction. The ulnar nerve enters the palm on a line immediately lateral to the tendon of the flexor carpi ulnaris. It passes over the anterior annular ligament in close relation with the lateral aspect of the pisiform bone. The ulnar artery lies immediately lateral to the nerve and severe bleeding in this region at the operation should lead one to expect injury to the ulnar artery and, in view of their intimate relation, the strong probability of concomitant injury to the nerve.

Pathology

In order that the maximum of regeneration may take place in a severed nerve, a clear conception of the current view of the pathology of the condition is essential to rational treatment.

When the nerve is cut the axonal processes distal to the cut are severed from their nutritive nerve-cell bodies and thus undergo Wallerian degeneration. The axonal fibrils break up and are removed by lymphocytes, the myelin also breaks up into small fatty droplets which are similarly removed by lymphocytes. The neurilemmal sheath remains and takes on an increased vital activity, as shown by the marked multiplication of its cell nuclei. The distal end of such a nerve-trunk may consequently be pictured as consisting of a collection of hollow neurilemmal tubes.

The proximal end of the severed trunk shows a completely different state of affairs. The axonal processes being in connection with their nerve-cell bodies are fully "alive" and show their abundant vitality by growing out of the severed proximal nerve end into the surrounding tissues. The myelin and neurilemmal sheaths do not grow out, however, and, as such a bare axonal process cannot live and function without its two protecting sheaths; the energy of the outgrowing axon will be misdirected unless it can find a neurilemmal sheath into which it can grow.

The distal cut end of the nerve consists, as we have seen, of a

collection of neurilemmal tubes and the essential factor in nerve regeneration is that the bare axonal processes from the proximal end shall be permitted to grow down into the neurilemmal tubes of the distal end.

It will be obvious from the above that to put the nerve in the best possible condition for regeneration the cut ends should be accurately sewn together face to face, so that the mouths of the neurilemmal tubes in the distal end shall be immediately facing the outgrowing axons of the proximal end. This surgical operation is known as end-to-end suture.

The details of the technique of end-to-end nerve suture need not be entered into here except to state that it requires considerable delicacy in its performance and that needles and suture material must be of a much finer texture than those which can safely be employed in the suturing of cut tendons. The aim in suturing a nerve is to pass sutures of very fine material, which will take up the fibrous sheath of the nerve only, so that the physiological processes which are to take place inside that sheath shall be interfered with as little as possible.

Practical Considerations

The first essential in the successful treatment of a wrist-wound must be careful and complete preliminary diagnosis. If this had been carried out in the third case quoted above the injury to the ulnar nerve could not have been completely missed.

For such a diagnosis both motor and sensory distribution of the median and ulnar nerves in the palm must be examined.

Motor

The patient is required to perform two test movements.

To test the median palmar motor supply the patient should lay the forearm and hand at rest with their dorsa on a horizontal surface. The thumb is placed touching the lateral aspect of the index finger. If, from that position, the thumb can be actively raised vertically the abductor pollicis muscle is not paralysed.

The ulnar motor power is tested by asking the patient to abduct the little finger from the ring-finger. This tests the power of the abductor minimi digiti.

Sensory

Any sensory loss of these nerves must be tested for in every case, both by a wisp of cotton wool and the point of a pin. It must never be taken for granted that a patient will always volunteer the information that part of his hand is numb. He may be forgiven for imagining that he is likely "to feel numb" after a severe wrist wound and that "it will all pass off".

Another reason for the routine testing of sensation is that the nerve may have been incompletely divided and the brunt of the injury may have fallen on the sensory fibres without any apparent loss of condition in the motor axons, as shown by the retention of power to perform the test movements.

If, after the above examination, a nerve injury is certain or suspected the case must be treated as a major surgical emergency and must undergo a thorough and complete surgical operation. By doing this the surgeon can be sure that he has ready at hand the three essentials requisite for an efficient nerve suture: good light, the proper instruments and an electric battery. The battery is used for stimulating the distal cut end of what one believes to be the nerve and thus causing contraction of the muscles supplied by it as sometimes, even in a good light, it is difficult to distinguish with certainty between a tendon and a nerve.

When a nerve injury is missed or inefficiently treated at the time of the accident, as in the three cases forming the basis of this paper, no later operative treatment, however skilfully performed, can be expected to give the good result which follows the immediate efficient suture of a nerve.

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GEORGE S. STRATHY

UNIVERSITY OF TORONTO PRESS

GRADUATE COURSES

The Faculty of Medicine announce that Graduate Courses will be given from May 26th to 31st, 1924. Clinics of a general character may be taken in Medicine or Surgery, dealing with Arthritis; Gastro-intestinal, Respiratory, Nervous and Skin diseases. Applications will be received by the Secretary of the Faculty up until May 5th, 1924. The above courses will be conducted provided twelve applications for registration are fyled by May 5th. The fee for each course will be $10.00, payable on registration.

The Department of Pathological Chemistry is prepared to give a short course in the more modern methods of urine and blood analysis. Applications should be made to the Secretary of the Faculty or the Head of this Department.

The Faculty regret to announce that it will not be possible for them to arrange for the course in Paediatrics, which has formerly been given in the month of July.

THE DEGREE OF DOCTOR OF MEDICINE

Some three years ago a change was made in the conditions under which the M.D. Degree may be obtained from the University of Toronto. The reason underlying this change was to provide a qualifying degree in the University of Toronto which would stamp its successful candidates as having had so broad and thorough a course that they would be entitled to regard themselves as experts in the field of internal medicine and competent to act as consultants therein.

The entrance requirements for this course are graduation in medicine plus a year's rotating service in a General Hospital. In lieu of this latter, years of clinical practice may be substituted.

The course is normally one of three years, of which the first and third are clinical, the candidate either serving as or doing work equivalent to a senior member of the resident service in a General Hospital. The final year must be spent in Toronto.

The second year is to be spent in a laboratory with the idea of the candidate obtaining a thorough knowledge of one of the scientific departments of medicine, and doing research therein, so that he may carry the result of this research on into the corresponding field of internal medicine.

A sufficient experience has now been accumulated to show that this change was a wise one and that both laboratories and hospitals can provide suitable opportunities for a number of candidates. The Faculty feels quite certain that were this course undertaken by any practitioner he would find it equal to any course offered by any other medical school on this continent or elsewhere.

Interested persons should communicate with the Secretary of the Faculty of Medicine, stating their qualifications and intimating if possible what line of work they would wish to pursue.

THE TREATMENT OF PLEURAL EMPYEMA

Norman S. Shenstone
(*Department of Surgery.*)

Empyema was a condition well known to the ancients and described very accurately by Hippocrates. His advice as regards the location of drainage is that followed by most surgeons to-day, and it is only within the last half century that any very real progress has been made in the treatment of the disease since his time. Even to-day there is no absolutely standardized treatment in use, and the writer claims no originality in the methods suggested below, but presents them because they have proved more successful than others in his experience. He has omitted any discussion of the disease except of those types relatively common in civilian practice following pneumonia and pleurisy with effusion, and has described also only enough of its gross pathology and symptomatology to indicate his suggestions for treatment.

Pathology

During the course of a pneumonia, organisms—most commonly pneumococci or streptococci—gain access to the pleura either by the rupture of a subpleural abscess or by way of intercommunicating lymphatics. As a result of that infection an acute inflammatory reaction takes place and there is an exudation of serum and leucocytes into the pleural space. In the beginning this effusion, particularly in streptococcus cases complicating broncho-pneumonia, is serous or seropurulent, unlimited by adhesion, and usually gravitates to the lower part of the chest, though it may be held in any part of the cavity, including the interlobar fissure. As the exudate becomes more purulent fibrinous material is deposited on the pleural surfaces especially at the periphery of the fluid collection, when the opposed layers are sealed together identically as in the peritoneum under similar circumstances. These primarily soft adhesions become firm and in time are organized; the pleural surfaces become thickened, lose their serous covering and gradually—three months has been considered an average period—the acute condition develops into a chronic one. At any time during the course of the disease complications such as pleuro-bronchial or pleurocutaneous fistulae,

subphrenic abscess and general systemic infection may occur. The outstanding pathological periods of the disease may be stated as, first, formative stage; second, stage of acute empyema; third, stage of chronic empyema, and it is under these heads that treatment will be discussed below.

Treatment

1. Formative stage during which the effusion is not yet limited by adhesions. This period may be short, as in many pneumococcus cases, when there appears to be frank pus from the onset, or prolonged indefinitely, as occurred very frequently in the recent influenza epidemic. In this period one must recognize that the patient is still suffering from the causative pneumonia to which the forming empyema is incidental, and that the aggravation of the severity of his illness is due not so much to absorption of toxins from the pleural cavity as to the physical pressure of fluid further limiting the capacity of the chest for breathing purposes and interfering with the heart's action. The presence of fluid is evidenced chiefly by increase in the local dullness and displacement of the heart.

Surgical treatment under these conditions should be limited to removal of the exudate by aspiration; any more radical procedure is highly dangerous as shown by the results of early operation during the influenza epidemic when many surgeons had a death rate as high as fifty per cent., before the wisdom of employing the minor method was recognized. Aspiration affords as much relief as drainage and has the further advantage of occasional cure, while those not so cured are left with relatively small cavities easily healed by subsequent thoracotomy. Aspiration should be repeated as soon as there is evidence of recurrence of fluid, and the utmost care should be exercised from the first that the puncture is done painlessly, otherwise the patient loses confidence in his physician and later attempts are attended by fear and shock.

At the site of the proposed aspiration all the tissues down to the pleura should be thoroughly infiltrated with a 1 per cent. Novocaine solution, introduced through a fine needle; a small puncture is made in the skin with a sharp-pointed bistoury which permits easy insertion of the trocar. Withdrawal of the fluid should be done slowly and stopped if coughing is excited or bleeding occurs.

2. Stage of acute empyema. In this stage limiting adhesions have formed, and the pneumonia has subsided, though more slowly than usual on account of the complicating condition. There has been a remission of all symptoms probably for a few days, with the gradual development of a septic type of temperature and increasing pulse rate due to absorption of toxins from the empyema and the increasing pressure exerted by the fluid contained within it. The usual physical signs are loss of vocal fremitus, absence of breath sounds and rales and the evidence of a displaced heart. In the less typical cases the signs are variable and, in the absence of X-ray examination, the only method of determining the diagnosis is by the exploring needle. The possibility of multiple collections should be kept in mind.

Treatment consists in either repeated aspirations or tube drainage. The former method has not produced many cures in the writer's experience, but in any case, it reduces the size of the cavity to be drained subsequently, and in this way tends to reduce the total period of convalescence. The only urgent indication for operation is the development of a pleuro-bronchial fistula, and when in doubt the less disturbing procedure is the one of choice. Aspiration should be repeated frequently, usually every two to three days, and should not be persisted in unless there is decided amelioration of the symptoms.

The first essential of operation for empyema is to procure efficient drainage. To insure this the incision should be placed over the lower part of the collection; the opening should be large enough to admit a rubber tube of at least 34 French calibre, and the tube should be firm and not easily collapsible. In adults a sufficient opening can be obtained almost always in the intercostal space while in children it is usually necessary to resect a rib. It is desirable, if possible, to establish drainage on the side of the chest posteriorly rather than in the back, to avoid the discomfort that is associated with tube pressure in the latter situation.

The writer believes that a continuous suction drainage, managed by some simple apparatus such as the Sprengel pump, is the best method of dealing with the purulent discharge. Such method makes for infrequent dressings—the original dressing has often

been untouched for from four to five weeks; it saves greatly in material; it is a preventative of secondary infection and aids in expansion of the lung. It has the disadvantage of keeping the patient in bed longer than when the exudate is permitted to discharge into a locally applied dressing, and it is obviously more satisfactory in hospital than in a private home. There can be no doubt however, that it gives the patient far more comfort and, in the writer's experience, it has markedly shortened the convalescence and reduced the mortality.

In all possible cases the operation should be performed under local anaesthesia, which very materially reduces the shock and respiratory distress that attend the use of a general anaesthetic.

Of the many described methods of performing an intercostal thoracotomy the following technique has been found most satisfactory to the writer. After a wide preparation of the affected side, the site of the proposed drainage is well infiltrated down to the pleura with a 1 per cent. Novocaine solution, the skin punctured with a sharp-pointed scalpel, and an aspirating needle inserted to determine the presence of pus. This having been demonstrated a grooved director is guided into the cavity along the needle which is then withdrawn. The patient should be instructed not to cough during this and the subsequent procedure so that air will not enter the chest and excite a paroxysm of coughing. Under the guidance of the director, a knife of 1/3 inch blade is then passed, dividing all the structures down to and including the pleura. With the director still held in place a tube of proper size and about three feet in length, grasped in a pair of curved forceps, is forced into the cavity so that its inner end projects almost one inch within it. The lower end of the tube is at once depressed and immersed under an antiseptic solution to procure siphon evacuation of the major portion of the pus and prevent its escape alongside the tube. A very small sterile dressing is applied and, with the tube, is held in place by strips of adhesive plaster.

The patient is then placed in the Fowler position (sitting posture) and the end of the tube is connected to the collecting bottle to which the Sprengel pump is attached.

Drainage is usually free during the first twenty-four hours, but

becomes progressively less profuse thereafter; the tube may usually be removed permanently at the end of the month, when the sinus tract should be irrigated, a dry dressing applied and the wound allowed to close.

If at any time the tube becomes plugged by fibrinous material it should be divided at a point about eight inches from the patient and an attempt made to remove the obstruction with a suction syringe. If this fails a small quantity of Dakin's solution or other antiseptic may be gently forced into the cavity and the cut ends of the tubing re-connected by a glass tube.

It has not been the writer's experience that irrigations are helpful in acute empyema.

Expansion of the lung may be aided by the use of blow-bottles, and the patient should be assisted in changing his position frequently.

The diet should be as nutritious as possible, and as high in carbohydrates and proteids as the patient can be induced to take. Milk and eggs are usually well digested and should form the foundation of the diet during the first few days.

3. Stage of chronic empyema. In this stage the purulent exudate is surrounded by a thick fibrous envelope; the patient has developed a considerable immunity to the disease and suffers chiefly with a low grade fever and a chronic cough with mucoid or mucopurulent expectoration. On account of the fibrosis, which involves the lungs as well as the parieties of the chest, little can be expected from aspirations alone and in most cases time is saved by a resection of one or two ribs, large tube drainage and frequently repeated irrigations with Dakin's solution. Treatment is nearly always prolonged and in probably one quarter of the cases further operative measures are necessary. A description of these very major procedures is beyond the scope of this paper.

The writer would like to make some reference to empyema following pleurisy with serous effusion, as many such cases are the result of infection introduced during aspiration by the physician. An infected pleurisy with effusion is one of the most difficult problems with which a surgeon has to deal; the cavities are always very large and the frequent tuberculous invasion of the pleura makes it almost impossible to secure closure of the drainage opening.

Every aspiration should be done with as careful a technique as for a major operation. A large field should be thoroughly prepared and instruments and surgeon's hands should be made as nearly sterile as possible. The widespread habit of placing a cotton and collodion dressing over the puncture wound is often, in the writer's opinion, the cause of infection in the pleural cavity. Pus forms frequently under such a dressing and follows the line of least resistance along the needle track. The application of a dry sterile dressing or a mere dusting of the area with an antiseptic powder is a safer procedure.

NOTES ON DIGITALIS

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Since the epoch-making work of Withering, given to the world in 1785, foxglove has been known to the profession as the most powerful weapon in our hands against weak heart associated with dropsy.

From Withering's time until about twenty years ago the use of this drug was guided merely by clinical experience and very little was added to the original directions of how to employ it. But when Sir James Mackenzie's polygraph came into use a new era of cardiology dawned and later the employment of the electrocardiograph has still further helped in the study and differentiation of the different forms of cardiac irregularity. But all through these revealments Withering's original directions for the use of the drug have largely held good. "Let the medicine be continued until it acts on the stomach, kidneys, pulse or the bowels; let it be stopped upon the appearance of any one of these effects, and I will maintain that the patient will not suffer from its exhibition, nor the practitioner be disappointed in any reasonable expectation." He stated that about thirty grains of the powdered leaf, given in doses of 1 to 3 grains twice daily, was necessary to produce a commencement of the nausea. By such treatment not only would the dropsy be lessened, but the drug "had a power over the motion of the heart to a degree as yet unobserved in any other medicine."

Much investigation has been done on digitalis with the object of isolating the different active principles of the plant, but most of the modern work is conducted with the whole drug as none of the constituents quite fulfil the effects of this.

When auricular fibrillation was clearly recognized as an entity it was also noticed that the failing hearts that best reacted to digitalis were usually those in which this delirium of the auricles existed, and some clinicians, notably Sir James Mackenzie with his numerous followers, went so far as to teach that it was only in such fibrillating cases that the drug had any special value. But while in the majority of cases of failing heart fibrillation of the auricles is present it was soon noticed that this was not always the case and it was realised that hearts might fail when the rhthym was regular and even when the rate was not hastened, and further that digitalis was useful here also.

Admitting that digitalis brings about so much improvement the question arises as to how the effects are produced and here a good deal of difference of opinion exists. In a case of auricular fibrillation, with symptoms of heart failure, such as oedema, cyanosis, venous engorgement of the organs and dyspnoea, the improvement can probably be explained as being chiefly due to a degree of heart-block that the drug produces so that the ventricles are to a less extent bombarded with impulses coming down from the fibrillating auricles. The result is that the ventricles beat more slowly and thus have more time to rest and to fill, and the contractions that do occur are consequently more efficient. So far all writers are pretty well agreed. But when it comes to the explanation of improvement in hearts that do not show fibrillation a divergence of opinion occurs. One might say that there are two schools of belief here. One group believe that all the improvement is due and alone due to the slowing of the heart rate through the vagus nerves while others think that the drug has also a direct effect upon the heart muscle, causing it to contract more powerfully and efficiently.

Dr. G. A. Sutherland of London, who belongs to the first class, has for years urged that the good effects of digitalis are entirely due to vagal slowing of the heart and sums up this opinion in a recent

address (Lancet, Dec. 8th, 1923, page 1222) by the axiom, "No slowing of the ventricular rate, no benefit from digitalis." He also says that he has yet to learn of any drug that directly increases the strength of the heart's contraction. He puts on one side all the findings of the pharmacologists which have so conclusively shown that in animals sufficient doses undoubtedly strengthen the contractions. His explanation would probably sufficiently explain the good effects of digitalis in fibrillating, failing hearts, but what about the regular and the unhastened ones? Christian has published several series of cases (the last in the Transactions of the Association of American Physicians, 1922, page 284), in which great clinical improvement was brought about by digitalis without any slowing of the heart and many other clinicians have had a similar experience. I have seen several examples of this even in the past year. A diuresis sets in, the weight lessens, the enlarged liver shrinks and the dyspnoea and other less easily measured symptoms of cardiac insufficiently disappear, so that the patient *feels* better. Here the benefit is evidently not due to any slowing of the heart as this is absent. In some instances a degree of slowing occurs but not sufficient to explain all the good effects.

The cases of regular but failing hearts are usually complicated with oedema, and, as said, a diuresis generally accompanies the improvement, with consequent loss of weight. It might be argued that the improvement was due to this diuresis and not to any direct action on the circulation but it is now generally believed that the diuresis depends upon the circulatory improvement and not on any direct action of the drug on the kidneys. Moreover, the engorged liver recedes and any cyanosis lessens and this could not be explained by the diminution of the oedema.

But even in cases of auricular fibrillation with heart failure evidence may be advanced that the digitalis acts at least partly directly upon the heart muscle. In such patients there is nearly always a degree of pulse-deficit, the pulse as counted at the wrist being slower than as counted at the heart because some of the beats fail to reach the periphery. Now when in such cases digitalis is administered the first effect noticed is often a hastening of the pulse at the wrist, that at the heart being still unchanged. What has

happened evidently is that the beats have become stronger so that more of them reach the radial artery. This observation I have repeatedly made, and the fact is noticeable in many published charts. The improvement cannot be due to any slowing of the heart as this has not yet occurred.

I think we may conclude that digitalis acts in two chief ways in bringing about improvement in cases of cardiac insufficiency:— (1) it stimulates the vagus nerves and thus causes a slight sinus slowing in regular hearts, and in cases of auricular fibrillation a degree of heart block which spares the ventricles, (2) it acts directly upon the ventricular muscle, causing this to contract more strongly and completely.

The first action, i.e., stimulation of the vagus is probably the chief but not the only cause of the good effects of the drug in cases of heart-failure with fibrillation of the auricles. The second explains the less dramatic but still very evident beneficent action of the drug in myocarditis, where the heart's action is regular and not necessarily fast and yet the organ is not able to do its work and oedema and other signs of failure are present.

Besides these two main effects digitalis has probably many other actions on the heart, such as decrease and then increase of excitability, increase in cardiac tone, etc., but with these we are not now concerned. As Canby Robinson puts it, "The beneficial effects exerted by digitalis upon patients suffering from heart disease are dependent, not upon a single mode of action of the drug on a single organ, but upon a combination of effects." (Medicine, May, 1922, page 42.)

As is well known, digitalis has no controlling effect upon the fibrillating auricles, but it is only too common to hear, in answer to the question, "what would be your treatment in a case of auricular fibrillation?" the reply, "give digitalis." I was astonished recently to read in A. J. Clark's Applied Pharmacology the following sentence, "The action of digitalis in *curing* auricular fibrillation of the heart was elucidated by Mackenzie." (The italics are mine). Mackenzie never taught nor did Clark mean that the drug cured auricular fibrillation, indeed later on he writes, "it does not, however, stop the auricles fibrillating." What digitalis does in these cases is to slow

the ventricles and restore the power of the heart to do its work. Many cases of auricular fibrillation have good compensation and such do not require digitalis. I came across a number of men on active service whose auricles were fibrillating and yet they had no cardiac complaints and of course did not require digitalis. On the other hand many regular hearts cannot do the work required of them and hence the circulation tends to fail and this failure is an indication for the drug.

It is chronic heart failure and not auricular fibrillation that is the indication for digitalis. And let me repeat, a fast heart may be an efficient one and a slow heart a failing one.

In nervous tachycardia, such as in soldier's heart, and in toxic conditions such as hyperthyroidism and chronic alcoholism, digitalis has little if any slowing influence upon the heart rate. In acute infectious conditions the drug has been much used either with the idea of "supporting" the heart through its period of stress or as a curative agent when signs of failure appear. It seems that simple rise in the bodily temperature does not lessen or even increase the action of digitalis, as has been shown by much experimental work on animals, but in fever due to infection the effects are less striking. It may be that the toxins of the disease inhibit its action to a certain extent. At any rate, although many clinicians believe that digitalis is of value in acute infections such as pneumonia, others are doubtful.

It is chiefly in chronic heart-failure accompanied by oedemia and occurring as a result of disease of the organ itself that digitalis is of so much value.

CHRONIC PAIN IN THE BACK AND BUTTOCKS

A lecture delivered before several of the county medical societies of Ontario under the post-graduate lecture scheme of the Ontario Medical Association.

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Chronic pain in the back may be divided into four main classes.

1. Local—due to disease of the structures of the back—joints, bones, muscles, nerves. These may well be called the "sore backs."

2. Thoracic abdominal and pelvic—due to gross lesions of thoracic, abdominal and pelvic organs. These may be called referred pains.

3. Constitutional—where the pain in the back is the result of a general debility of the body such as anaemia and faulty nutrition. These are the "weak or tired backs."

-4. Nervous—where there is little or no organic or functional disease of the body but where nervous upset expresses itself as pain in the back. These are the "nervous backs."

Local Disease in the Back

Disease of Muscles—In this class are included so-called myalgia, lumbago and chronic rheumatism. The large majority of chronically sore and stiff backs found in men are of this type. Ten years careful observation of a large number of cases of sore backs in army, out patient and private practice has convinced me that muscular rheumatism as a separate disease does not exist. Further, I am convinced that the pain of lumbago is not felt in the muscles or fibrous muscle sheaths and that "fibrositis," except as it may occur around affected joints as part of the affection of these joints, is not a cause of pain in the back.

Careful examination of several hundred cases of lumbago has revealed the absence of any detectable tenderness in the lumbar muscles with the exception of a few cases where tenderness was doubtful but could not be excluded. In most cases of lumbago similar pains to those complained of could be produced, without stretching or contracting the affected muscles, by moving the joints when the muscles were relaxed. In confirmation of this is the fact that myalgia and fibrositis, apart from the pains of "stiff muscles" the result of unusual exercise, cannot be found elsewhere in the body and it is likely that lumbago would never have been described as a muscular disease were it not that vertebral joints are so deeply buried by overlying muscles that their examination by palpation is impossible. Inflammation of muscles as a cause of pain in the back, I believe, can be disregarded. Tired overworked muscles may be the cause of tired backs but they are not the seat of pain in sore backs or lumbago. After unusual exercise the back muscles may be stiff and sore as the muscles of the arm are sore after unusual

exercise such as digging, pitching hay, etc. This form of pain in the back is a temporary one and where pain persists after several days another cause should be sought.

Disease of Nerves—Injury or disease of nerves are rare causes of pain in the back. When a nerve is pressed upon by bone or a tumour the pain is severe and agonizing and the distribution of the pain is limited to the area supplied by one nerve. This is seen occasionally in tumours and tuberculosis of vertebrae but otherwise almost never. Herpes Zoster in elderly people may leave a painful and tender area for months or years. The diagnosis of the cause is made from the history, the scars and the area of hyperaesthesia. The treatment is difficult.

Disease of Bones—Diseases of bones without involvement of joints is not common. Rickets, infantile or adolescent, may lead to kyphosis or scoliosis or a combined deformity. These deformities are never painful but such backs tire easily and may be more properly considered under the type of tired backs. Tuberculosis of the spine or Potts' Disease, occurring most commonly in children, should be easily recognized if the patient is examined as described below. To make a diagnosis between tuberculous and non-tuberculous caries may require X-Ray examination. Tumours of the spine are not common and diagnosis then is only made certain by X-Ray examination. In such cases the nerves may be involved.

Disease of Joints—Disease of the vertebral joints slight or severe is much the most common cause of a sore back or lumbago. The advanced stages of arthritis are easily recognized, the stiff "poker back" which is often part of a polyarthritis gives no difficulty in diagnosis but mild degrees of rheumatoid arthritis, gonorrhoeal arthritis or osteo arthritis may be easily overlooked. The patient complains of a stiff sore back, a liniment may be prescribed for his "muscular rheumatism" and examination of the back neglected.

Osteo Arthritis—Osteo arthritis of the vertebral joints is very common. It is infrequent before the thirty-fifth year and is more frequent after that as age advances. Its onset is seldom sudden but relief may not be sought until there is an acute attack. These acute attacks of lumbago may occur at long intervals with no pain between attacks. They are precipitated by exposure to wet and

cold but are most frequent in my experience during the season when acid fruits, especially strawberries, tomatoes and grapes, are freely eaten. Other patients, without acute attacks, may complain of a stiff slightly painful or aching back which may be stiff on arising in the morning but "limbers up" as the exercise of the day is carried out and the day becomes warmer. In some cases the pain is most troublesome after the days work is over. If a careful history is obtained it will usually be found that there is occasional pain or stiffness in other joints. A frequent history is that for a few days there are stiff fingers or an aching shoulder, then stiffness in the neck or slight occipital headache in the early morning followed a few days later by slight thoracic pains, as the inflammation leaves the cervical and descends to the thoracic joints, and often ends with a few days of mild lumbago or sciatica. A frequent association of osteo arthritis is so called acid indigestion. On physical examination commencing Heberden's nodes or crepitus in shoulders or knees or other joints is usually found. Examination of the back will reveal in all but the slightest cases some restriction of movement in the back. In all cases of pain in the back every joint in the body should be examined.

Rheumatoid and Infective Arthritis—Rheumatoid and infective arthritis are usually more acute and occur more frequently in younger people, and more commonly in men. The frequency of a gonorrhoeal history is significant although the gonorrhoeal infection may have preceded the pain in the back by many years. In these cases a urethral smear following prostatic massage frequently reveals the presence of a latent prostatic infection. A history of arthritis in other joints more acute than an osteo arthritis, is fairly common. The onset is usually more acute and pain is greater than in the chronic variety of osteo arthritis and loss of weight and strength may occur.

On examination rigidity of the back is more marked. In some cases the rigid "poker back" is found. The attack subsides more slowly and ankylosis may occur. The vertebral joints from occiput to sacrum may all be affected at once.

Method of Examination of Back

A proper clinical method of examination is of the highest im-

portance in diagnosis. The large amount of muscle and fat tissue over-lying the vertebral joints makes palpation of little use. The patient should be stripped down to the level of the great trochanter and stood with the back to the light and the examiner should sit squarely behind him. After inspection the muscles of the back should be palpated to see if there is any tenderness. This should be done by pressing the thumbs deeply into the lumbar muscles. Care should be taken to make the patient distinguiish between tenderness in an area and the pain which is felt in the same area. Malingerers always exaggerate the tenderness of pressure. After testing the tenderness to deep pressure the patient should be made to bend far forward with the chin touching the chest to see the shape of the back bow. In all but obese and elderly patients this should be an arc of a circle. Any area of restricted bowing should be noted. It may be wise to turn the patient sideways to view the bow of the back. In very slight and early cases of osteo arthritis there may be no restriction of movement. In all other cases of osteo arthritis, in rheumatoid arthritis and in caries of the spine movement is restricted to some extent. The next test is to make the patient bend backward to the fullest extent with the chin elevated while the examiner's thumbs are pressed deeply into the lumbar muscles on both sides. In arthritis most pain is complained of when the patient is returning to the erect position. The area of restricted movement is still present. In the malingerer or the patient exaggerating his pain, who complained of tenderness on deep pressure before, no complaint of pain is made when the weight rests against the thumbs pressed deeply into the back. The patient is too much engaged in keeping his balance to remember to complain of tenderness. Having examined the forward and the backward movements, the movements and shape of the side bow of the back should be tested by getting the patient to bend to the right and left with the under ear pressed over to the corresponding shoulder. The area of restricted movement is a gain demonstrated. Restriction of movement in the thoracic area is harder to judge owing to the ribs restricting all movements of the thoracic vertebrae.

The patient should then sit on an examining table and bend forward. If he has purposely restricted his movements in the pre-

vious tests the bow may be found to be perfect in this movement. Lay the patient on his back with the thighs and legs flexed. The examiner stands on the patient's right with his back to the patient's head, places his left arm under the patient's flexed knees and rolls him up on to his shoulders. The examiner looking down the crease of the back observes the bow again. This manipulation may be necessary because in disease of the sacro-iliac or hip joints forward bending may be restricted but when the thighs are flexed as in this manipulation the bend of the back is not restricted by disease in the hip and sacro-iliac joints.

Further test of the movements at the vertebral joints should be made by having the patient lie prone with the arms at the sides. The examiner facing the patient places his right arm under the thighs just above the patellae and raises the thighs until only the chest of the patient rests on the table. The back bend and the side movements may be thoroughly tested in this way but mild cases of osteo-arthritis, who showed restricted forward bend, may show no limitation of movement by this test. In more severe cases of osteo-arthritis, in rheumatoid arthritis and in caries of the spine restricted movement will always be apparent. If movement is normal as shown by the above tests, and if there is no sign of arthritis in the other joints of the body arthritis and caries of the spine can be excluded in nearly all cases as the cause of chronic pain.

In considering the vertebral joints it should be borne in mind that there are joints joining the articular processes as well as the joints joining the vertebral bodies. These articular process joints are close fitting and become painful even if slightly diseased and more movement takes place at these joints than in the joints between vertebral bodies because they are farther from the pivot point than the vertebral body joints. The latter do not fit closely so that there may be considerable osteo-arthritic changes around them without causing any inconvenience. On the other hand a small amount of inflammation or osteo arthritis in the joints between articular processes may give rise to much pain and disability. The most painful and crippling arthritis is found when the X-Ray demonstrates changes in the joints between articular processes.

Sciatica and Sacro Iliac Disorders

Sciatica is the most serious of the so-called neuralgias. In text books it is described as a neuralgia of the sciatic nerve which sometimes becomes a neuritis of the same nerve. It is remarkable that no demonstrable pathological condition of the nerves is found at post mortem examination of these cases. A few text books have recently drawn attention to the fact that it is difficult to differentiate some of these sciaticas from sacro-iliac disease. The fact of the matter is that about ninety-five per cent. of so-called sciaticas are arthritis of the sacro-iliac joint or lumbo-sacral articular processes joints. Sometimes there is a subsequent neuritis of the sciatic nerve. The other five per cent. include pelvic and intra pelvic tumours, tuberculosis of the sacro-iliac joint, rare disorders such as sacro-iliac sprains and slips and sacralization of a transverse process of the fifth lumbar vertebra.

A consideration of the anatomy of the region is necessary. The sacrum is wedged in between the ilia and joined to this by strong surrounding ligaments and fine intra-articular ligaments. The joint surfaces are in very close apposition and the joints contain a small amount of synovial fluid. There is normally a slight amount of movement in the joints. The sciatic nerves lie over the front of the joints, being separated from them by the ligaments only. The transverse processes of the fifth lumbar vertebrae are usually roughly quadri-lateral in shape and broader than the transverse processes of the other lumbar vertebrae. Not infrequently the processes, instead of tapering toward the ends, are bulbous on the lower border and may even articulate with the ilium or sacrum or both. These articulations may be the seat of arthritis.

When inflammation occurs in sacro-iliac joints, pain is referred to the buttocks and upper third of the back of the thigh but in severe cases the pain is referred as low as the heel. This pain is not due to neuritis but is in the referred pain area of the sacro-iliac joint and is similar to the referred pain area of the hip joint, which is down the front of the thigh to the knee, and to the area of referred pain of the shoulder joint which is down the upper half of the arm. Such is the nature of the pain which is commonly called sciatica. In most cases the sciatic nerve is not affected and there

is no tenderness on pressure over the nerve as it emerges from the great sciatic foramen but in a few cases the nerve itself is affected and there is tenderness along the course of the nerve with marked atrophy and weakness of the muscles supplied by it. Milder degrees of atrophy of the thigh and calf muscles may occur without neuritis of the nerve just as there may be atrophy of the muscles of the arm following arthritis of the shoulder joint or atrophy of the thigh muscles following arthritis of the hip. Some cases of arthritis of the shoulder joint may be followed by neuritis of the ulnar nerve. That lumbago and sciatica often occur together is to be expected for arthritis of the lumbar and sacro-iliac joints frequently occur in the same patient.

The importance of recognizing sciatica as due to trouble in the sacro-iliac or lumbo-sacral joints is that treatment directed to the sciatic nerve brings no results while counter irritation over the affected joint, and orthopoedic appliances are of the greatest aid in treatment. These treatments are useful allies to the general treatment of the arthritis which is of primary importance.

Treatment of Arthritis of the Spinal Joints

Since arthritis of the spine is of two main varieties, first, osteo-arthritis and secondly, rheumatoid or toxic or infective arthritis, and as the treatment of these diseases is so different it is wise to discuss separately the treatment of each variety.

Osteo-arthritis—The etiology of this disease is far from clear. Osteo-arthritis and other forms of arthritis being so frequently found in the same individual has made the study difficult. It is a general belief that rheumatoid arthritis is probably of infective origin, that is that it arises from foci of infection, teeth, urethra and tonsils frequently and less frequently from sinuses, gall bladder, septic sores or wounds. That foci of infection play any part in the etiology of osteo-arthritis is doubtful. Its onset is most commonly at the age when exercise is diminishing and yet intake of food has not diminished while the excretory organs may begin to be less efficient. In its acute phases it occurs most commonly during the months of June, July, August and September when the consumption of acid fruits is greatest. Attacks may be precipitated by exposure to wet and cold. The aching back is most troublesome

before the rain and after a long cold drive or after sitting in the cold after being over-heated. It is apparently more common in people who have a dry skin and do not perspire freely. Pemberton, Almon Fletcher and others believe that all arthritis is more common in people showing a poor tolerance to sugar, that is in people whose blood sugar rises to an unusual degree after ingesting 100 grammes of glucose, taken after a fifteen hour fast, or whose blood sugar level is slower in returning to normal after taking the glucose meal. Certainly a large proportion of osteo-arthritic patients take a high carbohydrate diet. In my experience it is as common in private as in hospital practice. An interesting association is the relationship between pyloric spasm or gastric hyperacidity and osteo-arthritis. About fifty per cent. of my private cases of osteo-arthritis complained of attacks of "hyperacidity" as well. In these cases the gastric and rheumatic attacks frequently occurred together. Most cases of hyperacidity improve with reduction of carbohydrate and the same is true for osteo-arthritis. Many patients who have occur in several members of a family. Many patients who have suffered from osteo-arthritis ultimately die of chronic Bright's Disease. Constipation aggravates the disease. Most acute attacks of osteo-arthritis and lumbago will disappear in a few days without treatment. Therefore it is very easy to be misled as to the results of treatment. As a result the laity have many cures for rheumatism. One Irishman insisted that blistering was the best cure for rheumatism because his father had been badly blistered when the liniment, which he had rubbed on his rheumatic knee, caught fire and the rheumatism promptly disappeared. He almost insisted on trying this treatment when his son had rheumatic fever. It is certain that osteo-arthritis is usually aggravatted by eating freely of strawberries, tomatoes and grapes or by drinking acid wines. The main indications for treatment are to study the whole condition of the patient, his exercise, his diet, the condition of his skin, kidneys and bowels. Where faults are found, endeavor to correct them. If the patient is over-eating, decrease his diet but especially his carbohydrates, and all acid fruits and wines should be forbidden during an attack and only taken in moderation afterwards. Carbohydrates should be sharply restricted during an attack and never allowed in excess in the future.

During an attack Turkish baths or sweat baths should be given every second day and water drunk freely. Between attacks it is well to keep the sweat glands active by warm woollen or silk underclothes and fluids should be drunk freely. In some cases six glasses of water daily will keep the patient free from attacks. The bowels should not be allowed to become constipated. Exercise should be taken regularly. Complete rest should only be allowed during the acute stages. For the pain local applications of rubefacient liniments, hot applications, cupping and mustard plasters are useful. Salicylates with alkalies should be given freely during acute attacks but they should never be relied upon to cure the disease. They are palliatives only. Codeine or morphine may be used during the acute attacks. I have had no experience with puncture of the lumbar muscles.

Where dental root abscesses or definite foci of infection are found it is unwise to leave them alone but it is not justifiable to remove teeth on suspicion and I have never seen any improvement of osteo-arthritis follow tonsillectomy.

Rheumatoid Arthritis—The treatment of this disease is entirely different. Focal infection is the main cause to be looked for but to eradicate the focus of infection is not the whole treatment of the disease. The original focus of infection may have subsided or been cleared out and still the disease progresses. The infection has long since spread from the original focus and the joints are infected. Therefore, one has three important points to bear in mind. (1) Clear out the original focus of infection. (2) Treat the infection in the joints. (3) Raise the patient's resistance to infection. In looking for the focus of infection it is well to trace the history back to the onset of the disease. Was there any infection just previous to the onset of arthritis? It is not uncommon to see tonsils and teeth removed when the history is that the patient had septic finger or gonorrhoea immediately preceding the onset of arthritis. When arthritis followed a sore throat it is wise to remove the tonsils. The prostate and seminal vesicles should be examined. Treatment by vaccines is worth trying but the results are disappointing. A common mistake is to over-look the general health of the patient. If the appetite is poor or the patient emaciated, forced feeding of

milk and eggs often gives excellent results. The benefit of fresh air and cheerful surroundings should not be forgotten. Rest with the back in the straight position is essential. These patients should spend many hours each day lying flat on the back without a pillow. The joints should never be allowed to ankylose with the back in a markedly curved position.

Pain in the Back due to Thoracic Abdominal and Pelvic Disease

When local disease in the back has been excluded by the above examinations attention should then be paid to the organs of the thorax, abdomen, or pelvis to see if they are the seat of organic disease. In the thorax mediastinal tumours and aneurysm are the only common causes of pain which may be referred to the back. Clinical examination or X-Ray examination will usually reveal them if present. The pain in such cases is usually in the region of the upper dorsal spines and never is referred to the lumbar or cervical areas.

Disease of the kidney is the most common abdominal cause of pain in the back. Acute nephritis may cause pain in the back but chronic nephritis never. It is humiliating to see cases of chronic pain in the back treated by medical practitioners for chronic Bright's Disease because of the common erroneous idea of the laity that pain in the back is usually due to the kidneys. Renal abscess, tuberculous or otherwise, may cause a chronic ache or pain in the back but the pain is unilateral and microscopic examination of the urine makes the diagnosis clear. A more common cause of slight backache is chronic or subacute pyelitis. It is common at all ages, very common in pregnant women and is usually due to the colon bacillus. Pyelitis is frequently overlooked, as it may not be revealed by chemical examination of the urine, but microscopic examination shows pus cells and motile bacilli.

Prostatis in my experience does not often cause pain in the back nor does enlarged prostate, malignant or otherwise, unless metastases have resulted. On the contrary malignant disease of the prostate as a possible cause of sciatica should never be overlooked.

When considering uterine disease or misplacements as a cause of chronic back pain one is on very debatable ground. My exper-

ience makes me take a strong position against uterine displacements, retroversions and cervical lacerations as a cause of chronic back pain. It is true they are often found in association with pain in the back but replacement by operation or pessaries or repair of the lacerated cervix seldom or never result in cure of the pain. It is true that tired debilitated women are subject to pain in the back and atony of the uterine ligaments. Rest in bed for a few weeks always ameliorates the pain of tired debilitated women but it returns soon after they resume their work. The temporary relief of pain in these cases is to be ascribed to the rest which follows their operation. Uterine prolapse which results from severe tears of the perineum may in some cases cause back pain but I believe it wise to attend first to the general health of the patient and to resort to operative procedure only when these measures have failed. Organic uterine and ovarian disease such as tumours and abscesses are to be estimated differently for they may cause pain in the back, On the whole uterine disorders, cervical and perineal tears have been given far too much consideration in judging the cause of lumbar pain.

Constitutional Disorders as a Cause of Back Pain

This constitutes by far the largest group of painful backs in women. Women as a rule eat too little and work too hard in proportion to the amount of nourishment they take. They also worry more than men. Women are especially inclined to shun protein foods as meat, eggs and milk. Their preference is for vegetable salads, tea and coffee. Women who eat freely of proteins are seldom ill and seldom tired. The "chronic neurasthenic" woman usually has a history of nervous or spastic indigestion, gradual reduction of diet, because she is afraid various foods will give her indigestion, loss of weight and energy, chronic constipation and then chronic debility, visceroptosis, with pain in the back and flatulence. If added to faulty diet a woman works too hard and has much worry, chronic neurasthenia with tired aching back is almost sure to follow. This class constitutes the great majority of the tired aching backs in women. The "tired" back is much more common in woman than the stiff and sore arthritic back.

Other causes, beside lack of food, which cause debility in

women are slight hyperthyroidism, chronic constipation and menorrhagia. A thorough investigation will usually reveal the cause of the debility and with the cure of the debility the pain in the back disappears.

A very striking case of this was seen in a woman of twenty-one years who complained of pain in her back which had been so severe that for seven years she had been unable to do any work except the lightest housework such as drying dishes and dusting. Her back was always tired and life was burdensome. She had had massage, spinal jackets and much medicine all without relief. Physical examination was quite negative. Her diet was entirely lacking in fresh food and almost no fruit or green vegetables had been eaten for years. Only salt meat had been taken. She was also very constipated. Given a diet of fresh food and bran, her constipation was quickly relieved. In two weeks the pain in her back was much diminished and she felt much stronger. In three months her back was not troubling her at all and she was able to do heavy housework without trouble. This case is cited as an example of the advantage of a minute investigation of the diet and general functions of the body.

Many cases of tired backs cured by rest and forced feeding of milk and eggs could be cited. The pain in the back disappears as weight and strength increase.

Pain in the Back Associated with Functional Nervous Disorders

When history and physical examination have revealed no cause for pain in the back one must always bear in mind the possibility of the pain complained of being the result of functional nervous disorder. Such cases are not rare especially in military or factory practice and where the question of compensation is involved. Apart from these there is a smaller class, more common in women, where the pain is "hysterical," or used as a protective measure to aid in an emotional struggle.

The malingerer or the man who exaggerates his pain can usually be detected by the facts that (1) the pain described does not correspond to the type of pain caused by arthritis, injury, thoracic, abdominal, or pelvic disease and the patient appears to be healthy, (2) the pain is usually described as severe and all symptoms are

exaggerated and (3) tenderness on pressure over the spine apparently causes pain when the patient realizes that the pressure is being put on, but if he or she is made to bend far backward and heavy pressure is applied no complaint is made, the patient's mind being occupied with maintaining the balance.

Where the complaint of pain is regarded as a protective phenomenon great care and tact is required in enquiring into the emotional state of the patient. Examination having been negative it may be well to start the enquiry by such a remark as "I have examined you thoroughly, I can find no cause for pain in your back. I suspect you have lost confidence in your back," or "I suspect that your nerves are out of order. Have you any cause for worry or have your nerves been upset?" Such a remark may be answered by the patient admitting that he or she is very worried or the answer may be of such a kind that the examiner is made suspicious that such is the case. Two cases may be quoted as examples.

"Mrs. K. had been a very healthy woman until she wrenched her back playing golf. After this she was in bed for eight months and received many varieties of treatment without any benefit. She was referred to me by Dr. W. E. Gallie, who suspected an emotional disturbance. Her physical examination was entirely negative. Careful questioning revealed the fact that she was much upset over an unfortunate love affair and her painful back was used as a protection to forestall the resumption of marital relations with her husband. She was greatly helped by being able to discuss her dilemma, which she had never been able to do, and soon came to the conclusion that she must get her emotions in hand and resume her normal married life. She was allowed a month in which to recover her control and given a special diet to serve as reason for her recovery. In this way she was able to explain to her husband and friends her rapid recovery. At the end of a month there was no complaint of pain or disability in the back and she has remained 'cured' for many years."

The second case illustrates how a painful back may be protective in another way. "The healthy wife of a divinity student complained of severe pains in her back of sudden onset. The pains only occurred on awaking, lasted for an hour each day, then dis-

appeared and did not prevent her from doing her housework. Such pains, of course, do not correspond with the pains of any disease. The examination being negative, she was so informed and asked about her worries. She finally admitted she had been much worried because her husband had volunteered for the foreign mission field and while she was 'anxious for him to do the Lord's work wherever it was necessary' she admitted that she and her family were much opposed to him going as a missionary because he was considered unsuitable for the work and she thought he was much better in parish work at home. She insisted that she was quite willing to go to the foreign field with him but admitted that, when she was examined to see if she was physically sound so that she might accompany her husband, she was very disappointed when she was pronounced fit. Their tickets were bought when she suddenly developed pain in the back and was put to bed. As a result their trip was cancelled and another missionary sent in place of her husband. Her husband was informed as to the state of affairs, withdrew his request to be sent to the foreign field and the pain in the back disappeared promptly. To save her reputation massage was ordered for a few weeks and she was thus able to account for her cure to her friends. This was necessary to prevent gossip."

Such cases are not very rare but it may be difficult to get to the bottom of the emotional upset. Where the pain in the back is used as a protective measure it is always necessary to find a way out so that the cause of the trouble will not be known to others. Unless an excuse is found and the problem solved the protective need is still present and a cure is made difficult.

As a result of a careful clinical study of painful backs, lumbago and sciatica extending over a period of ten years I believe the following statements are justified.

1. Lumbago is primarily an arthritis of the vertebral joints, and the pain is most severe when the joints between articular processes are affected. It is possible that muscles may be secondarily affected but the disease should not be considered to be a myalgia.

2. Acute torticollis is not primarily a myalgia of the neck muscles but is due to arthritis of the cervical vertebral joints.

3. Most cases of "intercostal" neuralgia are due to arthritis of the thoracic vertebral joints or the costo-vertebral joints.

4. Sciatica in most cases is due to inflammation of a sacro-iliac or lumbo-sacral joint but may be complicated by neuritis of the sciatic nerve.

5. Arthritis of vertebral joints is the commonest cause of chronic back pain in men.

6. In women the commonest form of back pain is the tired back which is usually associated with undernutrition. Lack of protein in the diet is the most common cause of these tired backs and superalimentation with milk, eggs and meat, if carried on for several weeks will usually cure the complaint.

7. Lesions of perineum, uterus and ovaries are usually overestimated as causes of back pain and are not common causes of "tired back."

8. Where no cause for chronic pain in the back can be assumed it should be remembered that a painful back may be used by hysterical patients and malingerers as a protection in their difficulties.

9. The exact cause of osteo-arthritis is not known but disordered metabolism or defective elimination is probably the main underlying cause. The best results in treatment are obtained by restricting acid fruits and carbohydrates and increasing the elimination by bowel, kidneys and skin.

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SOME PRINCIPLES IN THE TREATMENT OF BRIGHT'S DISEASE

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Bright's Disease is a diffuse process in the kidneys involving, in varying degrees, the capillary tufts, the epithelium of the tubules, and the interstitial tissue. The term "Bright's Disease" does not include the two other types of pictures in which the kidney plays a part, important but not primary, namely, poisoning by the metals, especially mercury and arsenic; and secondly, the toxic condition sometimes seen in pregnancy, called eclampsia.

One great cause underlies Bright's Disease, namely, *bacterial infection*. While the so-called acute infectious diseases are not as yet, except in the case of scarlet fever, definitely proved to be of bacterial origin, yet opinion is so strong to this effect that they may be included under this head. Causes of nephritis given in the older textbooks, such as exposure to cold, alcoholism and the like, are now felt to be operative only in association with co-existing bacterial infection. While it is true that many cases presenting themselves first in chronic form cannot be always easily related to bacteria the thought must arise that they may be late manifestations of a very mild infection of years before, or the expression of some area of infection existing still.

It follows then that the fundamental part of the treatment of nephritis is to search most thoroughly for any source of bacterial activity and to deal with such as effectively as practicable. Moreover, in connection with chronic nephritis, the reflection must arise that if a more careful watch were kept on the urine during the course, and particularly the convalescence, of infections of any sort, however mild, management at this time might prevent future trouble.

Of the infections, the ones most commonly seen to be followed by nephritis are those which attack the upper respiratory passages, and included here are "colds", septic conditions of the teeth and inflammation of the paranasal sinuses. There is one focus of in-

fection which, statistically, stands out above all others. This is *the tonsil.* There is no doubt that a great advance has been made in the recognition of tonsillitis in relation to nephritis, and it is now often considered wise to remove actively unhealthy tonsils just as early in the course of an acute nephritis as the patient's condition will possibly permit.

Another great advance has been made in the treatment, and also in the prognosis of nephritis, by studies of the functioning of the kidney in the individual case. The kidney normally eliminates nearly all of the nitrogen, most of the inorganic salts, and sixty per cent. of the water, which the body gets rid of daily. In disease it may or may not be able to perform one or all of these functions efficiently. If it is not, whichever of the waste products is not adequately eliminated will accumulate in the body and do harm. By ascertaining its ability to secrete nitrogen, sodium chloride and water, it is possible to so apply a knowledge of dietetics as to spare the diseased kidney in its work and to protect the body from retention of waste.

So-called functional tests have been devised which give information of a very practical nature. Of these, three are so useful and so simple of application, requiring neither technical skill nor laboratory apparatus, that they will be described in detail:

The Two Hour Test.—Seven four ounce bottles are required. The patient's regular habits are not modified for the test. Every two hours through the day the bladder is emptied, the amount is noted, and a specimen is obtained. From three hours after the evening meal until breakfast next morning the total amount is collected, the quantity measured and a specimen saved. If this simple procedure is adopted in the case of a normal person the following observations will be made: The samples closer to the meals will be larger in quantity and lower in specific gravity than the ones four hours after the meal, provided no fluid has been taken between the two specimens; the night specimen will average 400 c.c. (30 c.c. to one ounce) in the majority of individuals, and will have a specific gravity of 1018 or thereabouts; the variations in the specific gravity of the seven different specimens will be from seven to ten points and one specimen at least should be 1020.

The interpretation is that the water available for excretion by the kidney comes through early after a meal, whereas the nitrogen is at its height of excretion in the later specimen and the kidney is able to secrete it in a high concentration. The night quantity will, under ordinary conditions, be just enough to fill the bladder by morning so that the individual will not have to arise during the night. There will be just enough nitrogen left over from the day's activities to bring the specific gravity of the night quantity to about 1018. Thus it will be seen that the kidney is able to do its work in response to meals and to provide itself with a rest period at night.

The Water Test.—The patient empties the bladder and during half an hour drinks 1500 c.c. (50 oz.) of water. In four hours the greater part of this total quantity should be secreted, and the greater part of the four hour quantity should be secreted in the first two hours. This test, of course, is not safe to apply just after the disappearance of edema.

The Concentration Test.—The patient is directed to abstain from fluids to the greatest possible extent from four p.m. one day until four p.m. the next day. During this period the meals should contain a goodly quantity of protein and be of as dry materials as possible—lima beans, pancakes, eggs, meat, etc. By the afternoon of the second day the specific gravity should be 1028 or more.

From these simple procedures some very interesting observations may be made. For instance, it may be found that in a mild case of acute nephritis or in a chronic case with, let us say, the findings of: (1) albumin in the urine; (2) microscopic elements—tube casts, a few red blood cells, a few white blood cells; (3) some degree of high blood pressure; (4) some enlargement of the heart; the two hour test gives an average result. If this is normal we may then test the reserve power to handle nitrogen through the concentration test. If this too is normal we have a class of case we may style *nephritis with efficiency of functioning.* It would be a serious error to modify this individual's intake of nitrogen. For the human animal is a mixed feeder. It is considered that vegetable protein "needs to be built up in the ox" for human consumption. Deprivation of flesh food leads to a lowering of vigour and cutting down of total protein requires a quieter life. Thus a patient who

needs no such restrictions, even though he has the evidences of kidney damage, may be confidently spared the invalid's regime and gloomy prognosis which has so often been imposed on such in the past by want of any precise knowledge on the part of the physician.

On the other hand, it may be found in such a case that, whilst the two hour test gives a specific gravity reading of 1020, the concentration test will not show a reading much, if any, higher. In such a case the protein intake should be limited to the middle range.

Again, it may be found that there is narrowing of the range of specific gravities in the two hour test, at first always in the higher levels. This tendency to fixation of specific gravity, which in a badly failing case eventually includes the power to pass a dilute urine as well as a concentrated one, indicates a retention of waste product nitrogen in the body. Early in such a failing case, this nitrogen lag will express itself in an *even* secretion throughout the twenty-four hours, and there will be, therefore, the need for the patient to arise to void urine once, and later more often, during the night. This phenomenon is called, variously, *nycturia, nocturia,* and when there is thirst and the drinking and secretion of large quantities of water there is then said to be *nocturnal polyuria.* The badly diseased kidney eventually loses all power to do its work in response to the stimulus of meals so that the quantity of the night urine rises in proportion to the day urine. Eventually the quantity at night may exceed that passed in the day time, so great may be the lag. Conversely, in a patient presenting himself quite ill, who has evidence of chronic nephritis, without edema, *and who does not have nocturia,* a search elsewhere than in the kidney function should be made for the cause of the condition. An observance of this simple point will save much confusion.

The water test has two aspects. When a surprising rapidity of response to the water ingested occurs, such as happens in patients recovering from an acute nephritis, it is probable that the kidney is irritable to water alone. Persistence in crowding such a case with fluids in an effort to promote elimination of other products will probably result in fatigue of the kidney, and may be followed by retention of water as a result. When, however, there is a lag in water secretion the interpretation is more complicated. It has been

found that when salt is retained in the body water is almost invariably retained as well, presumably to keep the concentration of the soda within physiological limits. A delayed water secretion, therefore, may represent an inability of the kidney to secrete either water or salt. The estimation of the behaviour of sodium chloride in the body is very complicated. For practical purposes, therefore, we must link the retention of water with the retention of salt. A case of nephritis showing some dropsy must be limited in the intake of both salt and water. So also a case giving a somewhat slow response to the water test, even in the absence of edema, must be restricted appropriately in the intake of these two materials.

There are three other functional tests available which have the advantage of giving their results more quickly and with less trouble to the patient. They all require either apparatus or special skill.

The simplest of these is *Maclean's test.* In this, 15 grams of urea are given by mouth in 100 c.c. of water. The patient empties the bladder before the test and at one and two hours afterwards. Provided there is no diuresis going on in the patient, for any reason, one of the specimens obtained after the urea should show a urea percentage of two or over in a normal case. Maclean holds that this test will show a deficiency in nitrogen elimination on the part of the kidney even when this is not sufficient to be associated with retention of nitrogen abnormally in the blood. The urea in this test is estimated by the hypobromite method.

The *phenolphthalein* test consists in giving a minute amount of this pigment hypodermically together with 500 c.c. of water by mouth. The urine is collected at the one hour and two hour interval, diluted with water; soda solution is added and the depth of colour read in a colorimeter. The percentages of elimination should be 40 to 60 for the first hour and 20 to 40 for the second.

The estimation of the waste nitrogen, or end products of protein metabolism in the circulating blood, is work requiring technical skill of a high order. The tests in common use here are those for the total non-protein nitrogen, or for one or other of its components —urea nitrogen and creatinin. It must be emphasized, however, that excepting the speed with which accurate information may be obtained, there are few advantages possessed by these tests

over the simple studies of specific gravity already described. In the occasional situation in which such advantage occurs the information furnished by the blood work can usually be foretold, more or less, by the general observation of the patient's condition. The upper limits of the normal variation of these nitrogen values are, per 100 c.c. of blood: total N.P.N., 60 mg.; urea nitrogen, 30 mg. in the young to 40 mg. in the old; creatinin 2.5 mg.

By means of these tests the important part of the management of Bright's Disease—the dietary—can be administered with much satisfaction. To apply intelligently the information that may thus be obtained one must have regard to the amount of fluids to be given, must have some knowledge of the amount of protein and sodium chloride contained in the commoner food stuffs, must understand the principle of sparing protein burning in the body by the free use of carbohydrates in the diet, and must have an eye to the total caloric value of the diet prescribed.

Dietary principles in nephritis.—The tests for the functional efficiency of the kidney classify cases of nephritis, for purposes of dieting, into three main groups:

(*a*) Cases with perfect elimination of nitrogen, salt and water. This group includes only chronic nephritis.

(*b*) Cases with partially limited capacity to secrete either salt and water, or nitrogen, or both. This group includes mild cases of acute nephritis, cases recovering from severe nephritis, sub-chronic cases and chronic case gradually failing.

(*c*) Cases with severe failure of secretory capacity. Here are included severe cases of acute nephritis and end stages of chronic nephritis.

In cases of severe failure there is often suppression of urine for some hours. Hot poultices, sweats, purgation and hot colon irrigations may or may not avail. While trying in these ways to remove waste products and water from the system, it is probably wise to give from twenty to thirty ounces of fluid per twenty-four hours by mouth. If there is a returning secretion this fluid should be in the form of nourishment, in part at least. The body wear and tear is going on and during starvation some forty to fifty ounces of tissue protein is broken down daily. This must necessarily result in loss

of strength, but, in addition, as the kidneys are not doing their work, this nitrogen accumulates in the blood and body juices. Whatever the cause may be of the toxic manifestation of nephritis called uraemia, nitrogen retention is related to it. By making use of the principle that carbohydrates spare the burning of protein in the body, it is possible by giving the latter to reduce the breaking down of protein to 25 grams. This amount should be replaced by feeding.

Patients suffering from these severe phases of nephritis are very ill and require the simplest form of nourishment—milk is usually turned to, and 20 ounces of milk (30 c.c. to the ounce) will provide over 20 grams of protein. But milk is very low in total caloric value. If cream be substituted there will be the same percentage of protein and every gram of fat will give 9 calories, where a gram of protein yields only 4 calories. Thus a pint of 20 per cent. cream contains over 1000 calories. Cream may be diluted with milk, water or seltzer. To obtain a high carbohydrate value in order to spare the protein catabolism, sugar of milk is very useful, as it is not as sweet as cane sugar and may be used much more freely. It is well tolerated in severe illness. Each ounce of sugar (30 grams) will give 120 calories.

As soon as the digestion will permit, the total caloric value may be brought up by any sweet foods, fruits, and low grade vegetables prepared without salt. As the percentage of protein is very low in all these it may be disregarded.

It is undesirable to keep the protein intake below at least 50 grams for more than a week or ten days. If the condition of the patient is improving either more milk or cream, or eggs (6 to 7 grams protein each), and cereals such as bread, may be added. A liberal carbohydrate diet with the higher-grade substances, bread and potatoes, contains about 20 grams per day of protein.

In acute nephritis recovery is often fairly rapid. It is then desirable to increase the protein intake to 70 or 80 grams. The safety of this will be shown by the concentration test, and often this test will show a specific gravity of well over 1020 when none of the routine specimens have reached this point. There is then no objection to the introduction of some flesh food. An ounce and a

third of roast beef, beef steak or roast veal will give 10 grams of protein.

Before the knowledge we now have was available there was a strong prejudice against the use of the more complicated forms of protein. Consequently milk was slavishly adhered to, and as a patient's appetite returned it was met by increasing quantities of this apparently safe and simple food. Milk is so low in caloric value, however, that to obtain sufficient nourishment in total calories some two or three quarts would be required. This would contain too large an amount of protein. Moreover, in severe cases the amount of fluid and salt intake should be in accordance with the presence of edema on the one hand, or the findings of the water test on the other, and as a quart of milk contains all the salt (2 gms.) required by the body per day, it is obvious that milk can be quite a dangerous article in nephritis.

The cases with partially limited capacity, as detected by the functional tests, may be handled according to the plan just outlined for a recovering acute nephritis. The protein should be set at a level of 50 or 60 grams if the concentration test is not good. If the water test is not normal fluids should be limited and the salt intake modified. Amongst salty foods, gravies and meat soups are high in content.

Cases of chronic nephritis with good efficiency should be tested at intervals. Some of these cases, however, remain stationary for many years. And, as they are often first discovered by chance, as during an examination for insurance or a routine examination, it is very gratifyig to be able, with the aid of the functional tests, to reassure them.

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THE USE OF HYPNOTICS

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The employment of medicinal agents as hypnotics (somnifacients) is a question of great importance, and only the merest

outline of the subject can be here attempted. Generally speaking, sleep-producing drugs should be used with a very sparing hand and only after all other means have been tried in vain. But, while it is bad practice to give them too freely, when they may do more harm than good, it is equally bad practice to withhold these remedies when they are really necessary.

Sleep is essential to life, more essential, indeed, than is food, for an animal can go longer without nourishment than without sleep. We do not know exactly what the essential nature of sleep is, but we do know that it consists of an unconsciousness that at rhythmic intervals steals over the brain, and that during it many biochemical changes take place so that the subject eventually wakes with powers renewed for the carrying on of the functions of life.

As a rule the blood pressure is low during sleep, but there is much evidence that this hypopeiesis is an accompaniment and not the cause of sleep, and it has been recently shown by McWilliams that often the blood pressure is high during the repose, so much so, indeed, that cerebral haemorrhage or angina pectoris may then occur in the predisposed individual. A man who has a diseased circulatory apparatus which constrains him to go very easily during his waking hours may in a dream be subjected to such a rise in pressure that something gives way, and thus no doubt can be explained many deaths that occur during sleep.

The amount of sleep required by different persons varies greatly, and what may be sufficient for one may be quite insufficient for another. The middle-aged need on the average some seven or eight hours; infants spend most of their time unconscious, and the aged seem to require less and less as the years go by.

Whatever be the essential nature of sleep it is evident that it depends upon two factors, (1) the degree of irritability of the central nervous system, and (2) the amount of afferent stimuli reaching that system.

The irritability of the brain cells may be increased by toxins of various sorts, either produced in the body or introduced from without; by circulatory disturbances; by fatigue and neurasthenia, etc. Such an irritability is often an inherited weakness and insomnia tends to run in families. In the presence of this hyper-

sensitive central nervous system the normal afferent impulses that constantly reach it from all over the body may be sufficient to prevent sleep. But even if the first factor does not predominate and the brain cells are not unduly excitable sufficient afferent stimuli may arrive to inhibit repose. This is seen when a man is kept awake by an aching tooth, by worrying thoughts, by bright light, loud noise, or any bodily discomfort. When both factors are at work and there is both a hypersensitive central nervous system and some increase in afferent stimuli then sleep becomes doubly impossible.

When a sleepless individual comes to his doctor for relief the latter does not treat the insomnia but rather the sleepless patient, and there are few conditions in which this distinction is more important. In every case one must try to estimate the degree of insomnia and this is often difficult. A neurotic person will come with the story that he has not slept for a week and yet his very appearance shows that this is not the case. It has been well said that people sometimes dream that they have not slept! Again, as already said, the number of hours of sleep required vary and this must be taken into account in judging of the severity of the individual case. The other day an old lady told me that she was very sleepless and wakened at four o'clock every morning, but it turned out that she regularly went to sleep at eight so was not doing so badly, and certainly required no hypnotic.

In every case the afferent impulses should be reduced as much as possible and hence the sufferer should avoid light, noise, heat and cold. Cold feet are often a source of the trouble, and bed socks, or hot or even cold foot baths, may often be sufficient to bring about the desired result. Heavy meals in the late evening should be cut out and also tea and coffee and excessive smoking. If pain be the cause there is nothing like an opiate, but here one must beware. If the pain be likely to be of short duration it may be so treated, but in chronic cases such a therapy is apt to lead to habit formation and hence should be avoided. There is one exception to this rule and it is when the pain is due to some irremovable and fatal cause such as cancer, and then the days which are already numbered should be

made more bearable by the sufficient use of opiates. The danger of habit formation does not here exist.

A common form of insomnia occurs in elderly people with gastric acidity. Here both factors are at work in that afferent impulses from the disturbed stomach tend to keep the person awake and also there may be a degree of toxaemia which increases the irritability of the nerve centres. A hot alkaline drink at bedtime often acts here better than anything else.

Occasionally a person is "too tired to sleep" and in such a light meal may be given, or a stimulant, such as tea or coffee, which with most would tend to keep them awake. Such people invariably have low blood pressures. When the centres are disturbed by heart failure digitalis should be used and as this organ improves the sleeplessness will lessen. In many instances the circulatory unrest is of functional origin and hydropathy is here invaluable. Tepid baths may be used or the patient be wrapped in a wet sheet for about half an hour and then quickly rubbed dry. Such treatment is very soothing and probably acts by equalizing the circulation.

Where all possible disturbing afferent impulses have been controlled and all possible causes of increased irritability of the centres have been treated and yet sleep is wooed in vain drugs may be required. Dr. S. J. Gee used to say that "the great danger of sleeplessness was the drugs taken to relieve it", and while there is much truth in this dictum it is a little too sweeping. As already said, hypnotics should be avoided as much as possible, especially in chronic cases, but where sleep does not come we must remember its vital importance, and hypnotics may be the lesser of two evils. It is only necessary to see the improvement that comes over a bad case of pneumonia, who has been sleepless and who at last has had some hours of repose from the use of some drug, to realize that the withholding of the remedy would be a therapeutic sin. Life may be saved by a timely hypnotic.

When a somnifacient is necessary the mildest should first be tried and those that are the least likely to produce a desire for their continuance. The number of hypnotics known are legion and only a few of the best can here be mentioned, beginning with the mildest.

In some slight cases Aspirin (*Acetylsalicylic Acid*) has a dis-

tinctly sedative effect and may be given in a ten grain dose at bedtime. It is specially useful where some slight pain or discomfort exists.

Bromides are much used and can be given either in a single dose of 30 to 40 grains at bedtime or thrice daily in proportionate amounts.

Chloralamide (*Chloral Formamidum*), in the dose of 20 to 30 grains in solution flavoured with liquorice, is often useful.

Veronal (*Barbitonum*), 5 ot 10 grains is much used and is generally effectual. The soluble Veronal-sodium is in my experience not so good.

The Sulphones, *Sulphonal* and *Trional,* in doses of 15 to 25 grains, are active hypnotics. They are slowly absorbed and hence should be given early in the evening. It is found that they, and also veronal, often act well also on the second night and thus they may be given only every other day.

In very excited patients Paraldehyde and Hyoscine are of special value. The former has a very unpleasant taste but if the patient is semi-delirious this will not be noticed and in other cases it may be given in capsules or in a mixture disguised with glycerine, rectified spirit and cinnamon. The ordinary dose is one drachm. Hyoscine is best given hypodermically and an injection of 1/150 grain of the hydrobromide will often cause sleep in the wildest patient.

Choral Hydrate is the most powerful hypnotic that we possess next to opium. It is quickly absorbed and quickly excreted and hence is best given in small doses which can if necessary be repeated during the night. The official syrup contains ten grains to the drachm and this is a safe dose. None of the somnifacients so far mentioned are of much value when the insomnia is due to pain or great bodily discomfort. When these exist there is nothing that equals *opium* or one of its alkaloids, but they must be given with caution and never allowed to people for self-administration. Most cases of morphomania can be traced to bad companionship and hence can be termed vicious but one occasionally occurs as a result of professional administration. I once knew a profound laudanum addict who said she had used her drug for forty years since a

doctor had prescribed it for the after-pains of childbirth. The Dominion Drug Act is now so wisely and strictly administered that such a cause of addiction has become very unlikely, but still the physician should remember that when he uses narcotic drugs, which sometimes he must do if he would perform his duty properly, he is using edged tools.

Often a combination of hypnotics acts better than large doses of a single one. Thus five grains each of veronal and aspirin produces sleep as well as a much larger dose of the former and hence is preferable. Bromidia, which is very similar to the non-official *Liquor Bromo-Chloral Compositus,* is very useful in drachm doses. A drachm contains ten grains each of chloral hydrate and potassium bromide, with a small amount of cannabis indica and hyoscyamus.

When it is necessary to use hypnotics for some time (and such is not often the case) it is wise to vary them occasionally as patients become relatively immune to any one, and also the production of the habit is less likely to occur.

These scattered notes may be epitomized as follows:

1. Hypnotic drugs should only be used when nothing else will serve.
2. The mildest should always be first tried.
3. A combination of two or more is often better than a single one.
4. They should be varied from time to time.
5. Opiates should never be used in ordinary insomnia, but when great pain or discomfort exist and the cause is a passing one they are the most efficient of somnifacients.

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MODERN CONCEPTION OF SCARLET FEVER

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Owing to the constancy with which haemolytic streptococci of one type or another have been found associated with scarlet fever, they have long been considered as a possible cause of the disease. Attempts to prove their causal relations have encountered many obstacles. It would be impossible in the scope of this paper to incorporate a complete review of all the literature that has been written regarding haemolytic streptococci in scarlet fever. Accordingly references to such works as have been outstanding have been made.

For many years attempts have been made to classify haemolytic streptococci and to produce curative sera.

Marmorck (1895)[1] first attempted to produce a curative serum by immunizing horses against streptococci, using living cultures for injection. The serum obtained was used in high dosage of 100-200 c.c. Moser and Von Pirquet (1902-1903)[2] concluded that streptococci from cases of scarlet fever were different from those from other diseases. They found that sera from convalescent cases of scarlet fever consistently agglutinated streptococci from scarlet fever patients, in low dilutions, and serum from other sources easily. Salge (1902-1903) obtained similar results, Aronson (1903), Neufield (1903), Weaver (1904), claimed that they could not find any specificity of streptococci in scarlet fever by agglutination or otherwise. "It is quite evident that various workers disagreed as to the possibility of a specific strain of streptococcus for scarlet fever. This attitude persisted until 1919 when, due to concentrated efforts by a number of investigators, consistent results were obtained in regard to a specific grouping of haemolytic streptococci in scarlet fever cases."

Dochez (1919),[3] Dochez, Avery and Lancefield (1919), Havens (1919), Tunnicliff (1920),[4] Gordon (1921),[5] Bliss (1922),[6] Eagles (1923),[7] found that by agglutination experiments, absorption of

agglutinins; protection experiments, and to some extent by fermentation of sugars, the specificity of this group of haemolytic streptococci could be demonstrated.

In order to establish this specific group as the causative factor of scarlet fever, it was essential that the organisms should fulfil Koch's law. This was successfully carried out by Dick and Dick (1923),[8] who obtained their culture from an infected finger in a nurse on a scarlet fever ward. Successive attempts to reproduce the disease in animals were practically a failure. Following the injection of the animal a reaction occurred in the majority of cases, with an occasional rash and more rarely desquamation. Guinea-pigs were the most susceptible of all animals and a higher percentage of positive results was obtained. However, the clinical condition produced did not sufficiently resemble the disease to justify the designation of experimental scarlet fever.

Human volunteers were necessary for the solution of the problem, and accordingly several volunteers were experimented on. Active cultures were smeared on tonsils and pharynx and in one volunteer a typical case of scarlet fever was reproduced, which followed the usual course without complications. The series of human inoculations was limited to some extent due to financial remuneration required to compensate for the risk assumed by the volunteers. The streptococcus used was a pure culture and was recovered from the experimental case of scarlet fever and reproduced again in pure culture. This experiment definitely linked up the specific strain as the causative factor of the disease.

It was still necessary to show, however, whether the experimental case of scarlet fever had been caused by the haemolytic streptococci or a filtrable virus associated with it in culture. A second group of volunteers were used and inoculated with a culture which has been passed through a Berkfeld V filter. For two weeks following no reaction occurred and the group were again inoculated, using an unfiltered culture. One volunteer developed a typical case of scarlet fever 48 hours later. This conclusively proved that the disease was produced by the haemolytic streptococci and not by a filtrable virus.

Since the haemolytic streptococcus is present consistently in the throats of scarlet fever patients, and rarely found in the blood

stream, the rash itself must not be produced by a direct action of the streptococcus on the skin. It was found that the haemolytic streptococci produced a toxin, which, on being absorbed into the blood stream, caused nausea, vomiting, fever and a typical rash. The haemolytic streptococci must be grown on suitable media for toxin production and the culture is filtered through a Berkfeld V filter. The filtrate contains the toxin and its action can be destroyed by boiling.

This discovery was an important step and offered a scientific basis for future work. The toxin was the means for (1) developing a skin test for susceptibility to scarlet fever, (2) preventative immunization, (3) production of antitoxin.

The skin test, the Dick test, so called, in recognition of the original work of Dick and Dick, consists of the injection of scarlet fever toxin (dil. 1-1000), 1/10 c.c. intracutaneously on the anterior surface of the forearm. As a control toxin is used which has been inactivated by heating at 100°C. for one hour, 1/10 c.c. of 1-1000 dilution is injected intracutaneously at a point not less than 3 cms. from the test dose. These injections cause small wheals to be raised which disappear in a few minutes. Positive reactions usually begin to appear in from 4-6 hours after injection. At first they consist of small circles of erythema. This red area increases and reaches a maximum size and intensity in 18-36 hours. In less positive reactions the maximum is reached in 18-24 hours. The redness is frequently associated with some swelling of the skin. In the most strongly positive tests the reddened area continues to spread and swelling increases up to 36 hours after inoculation. Soon after reaching their maximum size and intensity the reactions begin to subside. Even the most strongly positive do not persist after 48 hours. The bright red colour becomes dull and begins to fade. The swelling disappears, leaving only a faintly yellowish area, which sometimes desquamates during 7-10 days following the test.

Reactions are classified according to their severity, that is, area of redness and intensity of induration and tenderness. Four types of reactions are as follows: (1) negative, (2) positive, (3) pseudo, (4) pseudo-combined. Readings should be made on the tests at

the end of 18 hours since many reactions fade rapidly from 18-24 hours. Negative reactions are only seen as a faint pink streak along the course taken by the needle.

A moderately large series of tests have been carried out to determine susceptibility of individuals by age groups from birth until adult life. The results indicate that the reactions are similar in mother and offspring during the first six months of life. The reaction persists in the child from 6-9 months of age. The percentage of positive reactors is greatest at 4 years of age, 60-70 per cent. gradually decreases after 4 years until adult life about 20 per cent. are susceptible.

Persons who have had the disease give a negative reaction in a majority of cases; showing that an immunity is conferred after an attack of scarlet fever. In active cases the test is strongly positive during the first 2-5 days and gradually becoming less positive after this time until at 12-16 days a negative test is the rule to which there are a few exceptions.

Immunization by Use of Toxin

When small amounts of toxin are injected into susceptible persons they may develop general malaise, nausea, vomiting, fever and a scarlatinal rash. These symptoms appear within a few hours after the injection and disappear within 48 hours. By beginning with a small dose of toxin it is possible to immunize susceptible persons without causing a severe reaction. The toxin must first be carefully standardized on human beings in order to determine the skin test dose. No animals have as yet been found which are suitable for standardization purposes. Persons are immunized by injections of toxin at 5-7 day intervals, beginning with a small dosage. This work as yet is only in an early stage of development but a working standard has been adopted by certain men as follows:

(1) Adults, 100-250-500 skin test doses.

(2) Children, 100-250-250 skin test doses.

Experience has shown that immunization must be carried to a point of a negative skin test. The first change that appears in the skin tests during the course of immunization is a more rapid fading. Later, usually within a week after the last dose of toxin is given, it

becomes entirely negative. The skin test should be repeated after 2-3 months as a safeguard.

Following an acute attack of scarlet fever it is evident that an immunity has been produced. For many years efforts have been made to produce curative sera and a few encouraging results have attended the use of these sera.

Antitoxin—In 1917 Schultz and Charlton made the observation that serum from a convalescent scarlet fever patient, if injected in 1 c.c. amounts intracutaneously, would cause blanching in a scarlet fever rash about the site of injection. This was called the Schultz-Charlton phenomenon and the explanation offered as to its mode of action was the neutralization of the toxin in situ in the skin. Thus serum from convalescent patients contains anti-bodies which are specific and would explain the nature of inherited immunity in the offspring for a period of six months. This property of convalescent serum has made it of value in active treatment in certain cases of scarlet fever.

In a similar manner to immunization, antitoxin can be produced by injecting increasing doses of toxin into a horse at intervals of 5-7 days. The antitoxin thus obtained must first be carefully standardized by making mixtures with varying quantities of toxin in known strength, and the mixture used for skin tests on susceptible individuals, before being used for active treatment.

Antitoxin added to a proper volume of toxin or convalescent serum plus toxin when used as a mixture for skin tests in individuals who have previously had strongly positive reactions will now give negative reactions.

The broadened outlook as to the causation of scarlet fever, the production of a toxin and antitoxin, has opened up many new channels for future research work on scarlet fever and many allied diseases. Knowledge of the present conditions may be practically applied with every hope of success.

Conclusions

1. Scarlet fever is caused by a specific strain of haemolytic streptococcus which can be distinguished from other strains by

agglutination experiments, etc., but not as yet by cultures of morphological characteristics.

2. This specific strain produces a toxin which will produce on injection a typical scarlet fever reaction.

3. The Dick test is a reliable index of immunity susceptibility to scarlet fever.

4. In conjunction with active immunization with scarlet fever toxin it will help in control of scarlet fever.

5. It serves to indicate the susceptible persons who need immediate passive immunization with scarlet fever antitoxin.

6. The Dick test is an aid in diagnosis of doubtful cases of scarlet fever.

7. The scarlet fever toxin is neutralized in multiple proportions by antitoxic sera.

8. Specific character of toxin produced by many different strains of haemolytic streptococci may be studied by use of the skin test.

9. Streptococcus group will be further investigated in other diseases for purpose of prevention and treatment.

10. A new impulse to study of scarlet fever has been given by recent successful advances.

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COURSES FOR GRADUATES AND PRACTITIONERS

The Faculty of Medicine of the University of Toronto wishes to draw the attention of graduates and practitioners of Medicine to the fact that they may register as Graduate Students and attend any of the lectures, clinics (in-patient and out-patient), ward rounds or other classes of instruction given to the senior undergraduate students. The post-graduate student may devote his time to the instruction in any one department or to as many as he may so desire. Courses to the final year are given in Medicine, Surgery, Obstetrics and Gynaecology, Ophthalmology, Oto-Laryngology, Paediatrics, Dermatology and Genito-urinary Surgery. All the library facilities of the University are available to such post-graduate students.

The University imposes a minimum fee of $10.00 per month for registration and attendance under the above conditions.

SOME OF THE RECENT WORK ON INSULIN

J. J. R. Macleod

Department of Physiology

Among the problems of metabolism which it has been possible to attack from somewhat new aspects by the use of insulin are two, by the investigation of which certain results of considerable interest have come to light. One of these problems concerns the physiological condition of depancreatised animals kept alive by daily injections of insulin, and the other the possible derivation of this hormone from other organs than the isles of Langerhans.

In a paper published a year ago in the British Journal of Experimental Pathology, by Allan, Bowie, Macleod and Robinson, it was pointed out that although depancreatised dogs could be maintained in excellent nutritive condition for periods varying from two to four months by the daily administration of insulin, they then succumbed to symptoms of acute hepatic breakdown, namely jaundice, bile in the urine and blood serum, entire loss of appetite, vomiting, increase of temperature and rapidly developing weakness. These symptoms could not be ameliorated by clearing out the bowels, and after the death of the animal they were found to be associated with an intense fatty infiltration of the liver, unaccompanied by serious lesions in the kidneys—except in one of the four cases—or by any significant histological change in the voluntary or cardiac musculature. It was concluded that the pancreas must be essential to the physiological well-being of the animal, quite apart from its rôle in producing insulin. Two reasons were suggested to explain how the absence of the pancreas might cause the fatty changes in the liver; the one being that owing to the absence of pancreatic juice a faulty digestive process would be set up in the intestine, and as a result toxic amines, or similar substances, by their absorption into the portal blood, would injure the liver cells and so lead to fatty changes; and the other, that some pancreatic hormone (other than insulin) necessary for the metabolism of fat had been withdrawn from the organism. In support of the former view it was observed that about fifty per cent. of ingested protein reappeared in the faeces, often in a completely undigested state and that only a small percentage of fat was absorbed. To this extent the observations lent support to those of Lombroso who, in 1910, concluded that the presence of the pancreas in the body is essential for proper absorption from the intestine, even when it does not actually secrete any digestive juices, a conclusion, however, which had been denied by McClure, Vincent and Pratt.

To put these suggestions as to the cause of the symptoms to the test of experiment the next step was to administer to the depancreatised animals not only insulin but the digestive enzymes of the pancreas as well. This has been done by feeding raw pancreas to two dogs, with

the significant result that one of them has now survived the pancreatectomy for over fifteen months and the other, for over eight months, both being at the present time in excellent nutritive condition. The daily diet in both cases has consisted of from 200 to 400 grams of meat and 50 grams raw beef pancreas along with from 50 to 100 grams of cane sugar, the dose of insulin, given twice daily, being varied in each case between 15 and 20 clinical units. There is no doubt that by giving the raw pancreas the absorption of both protein and fat has been very greatly improved and the absence of any symptoms of hepatic insufficiency may possibly be explained by the fact that no toxic products, due to a faulty (microbal) type of protein digestion, are being absorbed into the blood of the portal circulation. On the other hand this result does not negative the second suggestion, for it may be that by feeding raw pancreas some hormone, other than insulin, which is not destroyed during the digestive process, is absorbed from the intestine into the blood. To test this possibility we are at prseent giving depancreatised dogs trypsin in place of raw pancreas, but the results are not sufficiently forward to report at the present time.

We have attempted to investigate the problem in another way, namely, by measuring the amount of esterase in the blood. By use of the stalagmometer method of Rona, we have found in depancreatised animals, that instead of being decreased, this blood-enzyme is decidedly increased in amount. But it must be remembered that there is probably both an esterase and a lipase in blood and before we consider this part of our work as complete the blood lipase instead of the esterase must be measured.

Several other facts of possible clinical interest have come to light as a result of these observations. For example, it has been found that the fasting blood sugar is usually about 0.300 per cent., indicating that the animals are more or less constantly hyperglycaemic and yet, apparently, without any untoward effects. This does not imply that it would be safe to allow a human diabetic to carry so high a blood sugar, for there is an essential difference in the clinical condition as it exists in him and in the depancreatised dog; namely, that the diabetic patient still retains some islet tissue which must be protected from overstrain by keeping the blood sugar as low as possible. What the observation does show is that increased blood sugar *per se* does not cause the degenerative changes which some clinicians have imagined it to do.

Another fact of interest is that one of the dogs (9 months) has gone through a normal pregnancy and is now bringing up two of her family of five. She went through the pregnancy without any perceptible change in the sugar balance, but a few hours after delivery she developed severe symptoms of hypoglycaemia, from which, however, she spontaneously recovered. It would appear that the drawing of sugar from the body through the milk was responsible for these symptoms. In view of the belief, due originally to experiments by Carlson and Drennan, that the

developing foetuses may secrete sufficient insulin to protect the mother against the effects of pancreatectomy, the foregoing observation is of great interest. It does not, however, entirely disprove this hypothesis for although in our experiments no perceptible change occurred in the carbohydrate balance during the pregnancy it may be that this was because so much insulin was being given in any case that the small contribution of the foetuses could not make itself felt. Since the glucose equivalent of insulin is so very much greater with small as compared with large doses (Allan) the foetal contribution of this hormone, in the absence of injections of the hormone, might have a pronounced beneficial effect on the mother.

Finally, it should be pointed out that there is every indication that these two animals are completely depancreatised, for both of them become intensely diabetic whenever the injections of insulin are discontinued. It is very significant also that in three days and over, after withdrawal of insulin and food from other similarly treated animals, the blood sugar has been found to be decidedly higher in fat as compared with thin animals. The question arises whether this may indicate the derivation of sugar from fat (Chaikoff, Markowitz and Simpson.)

Another problem of clinical interest concerns the source of insulin in the animal body. The isolation of substances capable of lowering the blood sugar of normal animals from all sorts of materials, both animal and vegetable in origin (Collip, Winter and Smith, Best, etc.), and even from the tissues of diabetic animals (Best and Scott) naturally raises the question as to whether the Isles of Langerhans of the pancreas can, after all, be the exclusive source from which the intact animal derives this hormone. On account of these facts some authors, notably Oertel and Swale Vincent have formally challenged the islet hypothesis of diabetes. Supplementing the excellent anatomical and pathological evidence upon which originally this hypothesis was built three proofs of a different character arising out of the present work may be added. The first of these is the fact, alluded to above, that the discontinuance of the injection of insulin into depancreatised dogs causes severe symptoms of diabetes to supervene within a day or so, followed by death in a remarkably short period of time unless insulin is again administered. If tissues other than the pancreas can produce insulin why do they fail to do so under these conditions? The insulin that is extractable from them must be incapable of functioning in the depancreatised animal and pancreatic insulin only can prevent diabetes.

The second and third proofs have been obtained by work on certain of the bony fishes (Teleostei) such as the angler fish (Lophius piscatorius) and the sculpin (Myoxocephalus) in which the pancreas does not contain the usual islets of Langerhans, these being collected into encapsulated glands of considerable size, situated outside the pancreas, usually in the neighbourhood of the spleen and the pylorus. Two years ago I found that extracts prepared in the usual way from these

principal islets, as they are called, contained very large amounts of insulin, whereas none was obtainable by exactly the same technique from the pancreas itself. McCormick and Noble have also prepared large amounts of insulin from the principal islets of the cod and pollock. More recently, Swale Vincent, Dodds and Dickens have found that *some* insulin may be prepared by the picric acid process of Dudley from the pancreas of these fishes, but they admit that the yields obtainable are very small compared with those from the islets. It may be that the few scattered microscopic islets, observed by Slater Jackson and by Scott in the pancreas itself, are responsible for these effects. But even this overwhelming presence of insulin in the principal islets, as compared with the pancreas proper, is not absolute proof of the insular hypothesis; and since we may consider the present as a test case, not only of the islet hypothesis but also of the general principle that difference in function is often related to essential differences in structure, McCormick and I have attacked the problem in another way. In the sculpin it is possible, by performing laparotomy, to excise the principal islets without much trouble. The operation lasts from 15 to 20 minutes and the fish soon recover from its immediate effects and swim about in a normal manner when returned to sea water. The blood sugar measured in fish removed on various days following the isletectomy was found to be markedly raised, indicating the existence of severe diabetes; but before attributing this to the isletectomy it was necessary to take into account the fact that, for some days (4 to 5) after exposure to air, the blood sugar—normally about 0.035 per cent. in this fish—is apt to be raised (asphyxial hyperglycaemia). We found, however, that it was decidedly higher in fish from which the islets had been removed; and more decisive still, that the hyperglycaemia continued after the fifth day, by which time that due to asphyxia had almost invariably disappeared in unoperated fish. There can be no doubt that removal of the principal islets, without disturbance of the pancreas, causes marked hyperglycaemia in the sculpin; and since this is the cardinal symptom of diabetes, it seems justifiable to conclude that the fish has become diabetic. In support of this it may be mentioned that the liver of the diabetic fish was found to contain distinctly more fat and less glycogen than those of the controls.

The final proof is still lacking, namely, to see whether administration of insulin to the isletectomised fish would prevent the development of the diabetic symptoms. This experiment we hope to do at the earliest opportunity. Meanwhile, however, we have investigated the effect of insulin on normal fish (sculpin), or on fish rendered hyperglycaemic by asphyxia; and in neither case have we been able to show that it has any very marked influence in lowering the blood sugar. This is strange, and may be related to the low body temperature which allows the excess of injected insulin to be excreted before it can act, or may be due to a mobilization of sugar out of glycogen or other sources which proceeds at the same rate as insulin can act.

CARCINOMA OF LIP, TONGUE, MOUTH AND JAW

H. W. Wookey

Department of Surgery

This article is based on a study of all cases of carcinoma admitted to the Toronto General Hospital during the years 1919 to 1923 inclusive, and on analysis of 178 cases of cancer occurring on the lip, tongue, and in the mouth during the past ten years.

In the period of five years, 1919 to 1923, 2,218 cases of carcinoma generally were admitted to the hospital, and it may be of interest to note that of these 2.6% occurred on the lip, 3% on the tongue, and 4.6% in the mouth and jaw. The majority of the cases classified as jaw cancers were in reality secondary to the disease in the mouth. Only four true cases of carcinoma of the maxillary antrum occurred, and these will be referred to specially.

An effort was made to study in detail each of the 178 cases of oral cancer and to determine if possible the ultimate results. It has been impossible to account for all of these cases, as many have disappeared and no information can be obtained. In speaking of results we have confined ourselves to those cases whose fate is definitely known.

Carcinoma of the Lip. There were eighty-three cases in our series of lip carcinoma. All except one occurred in men.

Age—The youngest was 32, the oldest 99 years, the average age being 61.

Site—With one exception the disease began on the lower lip, and in the vast majority of cases, towards the angle of the mouth rather than the centre. The left side of the lip was the most favoured situation.

Aetiology—In a small number of cases there was a definite history of injury, or a pre-existing mole or wart, but in the majority the onset was insidious—a small abrasion or crack of the lip constantly recurring in the same situation, often a "cold sore" which did not respond to treatment. In several cases broken irregular teeth corresponded to the site of the growth. Oral sepsis was almost constantly present. Syphilis would appear to play little or no part, as in only two cases of the series was a history of syphilis and a positive Wassermann obtained. Many of these patients stated that for years there had been a small "pimple" or scab on the lip which became larger, began to bleed or to be painful. Many of the patients were non-smokers but in several instances it seemed reasonable to believe that the condition had been caused by pipe-smoking.

Symptomatology and Physical Signs—The duration of the condition when the patients first came up for treatment varied from three months to eight years, the majority being admitted to hospital six months to

a year from the time of onset of the disease. Many of these cases had been treated by local applications, plasters, cautery, etc. The physical appearances of the growth were as follows:

1. A simple fissure or crack with a hard indurated margin.

2. An ulcer with a sharply defined margin and a hard base.

3. A wart-like excrescence, some of which were very large, involving a wide area of the lip, ulcerated and sloughing. In a few cases the entire lip was invaded. The regional lymph glands—sub-maxillary, sub-mental, and cervical—were found to be enlarged in 60% of the cases. These glands were firm, fixed and tender. In the majority of cases the sub-maxillary set of lymph glands were the first to be involved. However, in the cases in which the growth was near the middle line, the submental group were primarily affected. In several instances a "V"-shaped excision of the original growth had been made previously, a recurrence having taken place in the scar or in lymph glands.

Pathology—In all cases the tumors presented the appearance of a squamous-celled carcinoma. In the cases in which the lymph glands were enlarged only 18% showed carcinoma, the remainder showed chronic inflammatory changes.

Treatment—In seven cases, that is to say in 8% of the series, the condition was deemed inoperable. A wide excision of the lip growth, with or without a block dissection of the regional lymph glands, followed by deep X-ray therapy, was the usual treatment. The best results were obtained in those cases in which the sub-maxillary, salivary and lymph glands of both sides, together with the sub-mental group and the cervical, on the affected side, were removed. The operative mortality was nil. It was possible to trace 60% of the cases after leaving hospital, and of these 35% can be regarded as cures. 58% have died of carcinoma, 7% are still living but showing signs of recurrence. Considering that many of these cases were treated late in the disease the results have been most encouraging, and many of the untraced cases are undoubtedly living, as no record of death in the Province of Ontario is registered.

Carcinoma of the Tongue. There were sixty-eight cases of tongue cancer in our series.

Age—The youngest was 36, the oldest 77, the average 57, or somewhat younger than the lip cancers.

Sex—Seven of these cases were females, sixty-one males.

Site—In the vast majority of cases the disease began on the margin of the tongue, and more commonly in the anterior two-thirds. In a few instances the tip or base of the tongue was primarily affected, but in none of the cases was the dorsum the seat of the disease.

Aetiology—In a few cases a definite history of injury was obtained, usually a bite of the tongue, or trauma, as by broken pipe. In a large number of cases, broken, irregular or decayed teeth corresponded to the

site of the disease. Oral sepsis was almost invariably present. In only 10% of the cases was a history of syphilis or a positive Wassermann obtained, and even in these cases it is doubtful if the lesion was ever a syphilitic one primarily. In all the cases in which syphilis occurred it would appear that valuable time was lost in treatment of that disease before a section revealed the true nature of the condition.

Symptomatology and Physical Signs—The duration of the disease when first admitted to hospital varied from one month to a year, the average time being five months. In some cases the onset was insidious, but as a rule pain was an early symptom. Pain on movement of the tongue often referred to the ear or region of the tonsil. A painful fissure or ulcer, more rarely a painless lump, first attracted the patient's notice. On examination an irregular ulcer or fissure with a hard base, or a lump with ill-defined margins was found. The tongue was painful, and slightly or completely restricted in its movements. In 50% of cases submaxillary and deep cervical lymph glands were found to be enlarged, firm and tender.

Pathology—In all cases squamous-celled carcinoma with marked infiltration of the muscle bundles was present. 20% of the glands noted as enlarged were malignant, the remainder showing signs of inflammation only.

Treatment—Seven cases of the series appeared hopeless from the outset, and died soon after admission to hospital. The treatment of carcinoma of the tongue has undergone many changes in recent years, nor indeed has it yet reached a stable and universally accepted basis. In the past the results have been very discouraging. In the earlier years of our series the treatment of choice was a partial or complete excision of the tongue, with or without a preliminary ligation of the lingual artery, and a dissection of the regional lymph glands. The results in these cases were discouraging and there has been an increasing tendency to some more conservative form of treatment. Fulgurization or cauterization of the local lesion, followed by an excision of the lymphatic glands, or deep X-ray therapy came into vogue. Of recent years radium has been extensively used,—the methods of diathermy and electro-coagulation tried. These methods have tended to replace other operative procedures, and it would seem that the best and most encouraging results have followed the combination of these measures with a block section of the regional lymph glands. It is as yet too early to speak of our ultimate results as a five year period is considered necessary for a cure. On the whole we have reason to believe that the combination of methods suggested above holds out a definite prospect of cure in the early cases, and certainly of prolonging life with the amelioration of symptoms in the more advanced cases.

Carcinoma of the Mouth. In our series there were twenty-four cases of carcinoma originating in the mouth, other than the tongue or jaw.

Age—The youngest was 42, and the oldest 70. The average age was 55 years.

Sex—Twenty of the cases were in males, four in females.

Site of Origin—The floor of the mouth, or the alveolar margin of the jaw, were the commonest situations for the beginning of the disease. The inner side of the cheek, roof of the mouth, or pillars of the tonsil follow in frequency in the order given.

Aetiology—In all these cases oral sepsis was a marked feature, pyorrhoea, broken decayed teeth, being invariably found. Syphilis seemed to play no part, as in no case was there a positive Wassermann.

Symptomatology and Physical Signs—The duration of the disease when first patients were admitted to the hospital varied from one month to three years, the average time being six months. A ragged irregular ulcer, with a sloughing base and a wide area of induration surrounding it, was the commonest picture seen. It was extraordinary, in some of the individuals, how extensive the condition had become, before they became conscious of it. Salivation was a prominent sign in many of the cases. Where the disease began on the floor of the mouth, the tongue was early involved and its movements restricted. In the cases in which the tongue or pillars of the tonsil were involved, pain was a marked feature. Sharp shooting pain, often referred to the ear or occipital region, was constantly present. The onset of the disease in most cases was insidious and far advanced before treatment was attempted. The submaxillary and deep-cervical lymph glands were found to be enlarged in 90% of the cases. The deep-cervical glands were the ones most often affected.

Pathology—All the tumors proved to be squamous-celled cancers, most of them showing extensive necrosis with marked leucocytic infiltration. In the cases in which lymph glands were enlarged 25% showed malignancy, the remainder showing only inflammatory changes. Involvement of bone, either the maxilla, mandible or palate bones, was present in all extensive cases, and destruction of bone in several instances was marked. The problem of osteomyelitis complicated the condition in many cases and sepsis or lung abscesses brought about a fatal issue.

Treatment—From a surgical point of view most of the cases of this type have been considered inoperable, very few radical operations being attempted. The local destruction of the tumor by cautery, fulgurization, diathermy, or radium has been the treatment commonly employed. In many cases a block dissection of the regional lymphatics has been done. The results have not been encouraging. Most of the cases whose fate is definitely known have died, sepsis and lung complications rather than carcinoma being the cause of death. However, there are a few cases in which the primary growth has disappeared, and although it is too early to regard them as cures we feel that the lives have been definitely prolonged, and there is the hope of ultimate cure.

In all these cases of intra-buccal carcinomata where there is sloughing, haemorrhage is a considerable factor, secondary haemorrhage having been responsible for several fatalities.

Carcinoma of the Jaw. Only four cases have been included in this group and the disease originated in each case in the maxillary antrum. All other jaw cancers—so-called—being secondary to primary growths in the mouth, are excluded.

Age—The ages vary from 46 to 65, the average being 52.

Sex—Two were males and two females.

Site—In all cases the disease originated in the antrum.

Aetiology—Chronic nasal infection seemed to have played a part in all cases.

Symptomatology and Physical Signs—The onset of the disease was insidious and the condition was far advanced when first admitted to hospital. An offensive nasal discharge was the first sign in two of the cases. In the remainder there was an alteration of the shape of the maxilla. Prominence of the cheek, a pushing upwards and outwards of the eye, indicated the source of the trouble. On examination the nose on the affected side was found full of offensive growth. A bulging of the palate was observed in two cases. Severe pain, neuralgic in type, in the roof of the mouth, or back of the eye, was present in all cases. There was no enlargement of regional lymph glands.

Pathology—The tumors were all columnar-celled carcinomata, showing degenerative changes and the results of secondary infection. There was always a marked destruction of bone, perforation of the palate occurring spontaneously in one case.

Treatment—Conservative treatment was employed in these cases. Cautery or radium was used for the destruction of the growth, access being gained by removal of the outer wall of the antrum in one of the series. One of the cases was alive and well after three years, two are dead, and the fate of the fourth is unknown.

To anyone who reads this paper it will no doubt seem that the mortality in cancer in the mouth or on the lip is extremely high. There is no doubt that this has been so in the past, but we feel very strongly that it has been due to the fact that the majority of cases were seen very late in the disease. In the cases in which treatment was early, the results in all types have been most encouraging. We feel satisfied that with the greater co-operation of the medical profession generally we will be able to improve vastly the report on our treatment of oral cancer. In doubtful cases no time whatever should be lost in arriving at a correct diagnosis. In any individual over forty years of age any lesion of the lip or in the mouth must be regarded with great suspicion, and immediate steps should be taken for removal of a section for microscopic diagnosis.

EYE CONDITIONS IN PREGNANCY

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The ophthalmological findings of pathological obstetrical cases during the past two years' experience at the Burnside may be of help to those handling obstetrical cases.

The findings varied from hysterical blindness to total blindness, optic neuritis, detachment of the retina, thrombosis of retinal vessels, retinal hemorrhages. All were found.

There may be some difference of opinion as to the classification of the various toxemias, but in order to have at least a working basis on which to pin the various fundus findings, I will give what apparently is recognized as a fair division of this subject leaving out the term eclampsia as at present it practically covers the very severe forms of toxemia and is not treated as a separate entity. I will deal with the three great types:

(1) Acute Toxemias of Pregnancy.

(2) Chronic Nephritis.

(3) Recurrent Toxemia of Pregnancy.

(1) *The Acute Toxemias of Pregnancy*

These form a rather definite clinical entity. This form is more common in primiparas, usually occurring in the latter months of pregnancy. The onset is rather sudden, generally there are premonitory symptoms as headaches, malaise, spots before the eyes and transitory loss of vision, followed by convulsive seizures. The urine is scanty and may boil solid with albumin. Labour usually occurs spontaneously and if the patient survives, the urine becomes normal in a short time, and subsequent pregnancy may take place without fear of a recurrence of the toxemia.

Cases going to autopsy show hemorrhagic liver changes with thrombosis and necrosis, also cerebral hemorrhages. The kidney changes are similar to the liver changes and not at all like the nephritic type. Another interesting point is that the secondary kidney damage (for this is not a primary kidney lesion) may be severe enough to cause permanent changes, so that in succeeding pregnancies the patient may have a true nephritis. The treatment in general is to empty the uterus more quickly in these cases than you would in the cases of chronic nephritis in which the chance of sudden convulsions would perhaps be less, but, of course, all cases are judged on their merits and everything is considered before terminating the pregnancy.

(2) *Chronic Nephritis.*

This includes patients who before pregnancy had, unknown to themselves, chronic nephritis and the extra burden of pregnancy caused the

process to become severe. The onset is gradual, appearing usually in the second half of pregnancy. The symptoms are more or less those of chronic nephritis. The urine does not contain as much albumin as in the acute toxemias but has more casts, and if convulsions supervene, the urinary picture will be that of an acute toxic nephritis.

From a practical point of view these cases must be handled differently to the acute toxemic cases, for following the pregnancy the blood pressure remains up, the urine has albumin and casts, and succeeding pregnancies will be sure to have toxic symptoms and increased kidney and ocular changes.

As Williams has pointed out, these cases are apt to have premature infants either dead at birth or shortly after. The placenta shows infarcts as a rule in such cases. The chances for having a healthy baby, if the case is at all severe, are relatively poor. It is usually safer to carry these cases along farther than the acute toxemias as there are usually more warning symptoms before convulsions set in.

(3) *Recurrent Toxemia of Pregnancy*

These have been more recently described by Foster Kellogg as the recurrent toxemias of pregnancy. This type has urinary changes, high blood pressure, etc., in succeeding pregnancies but between pregnancies in contra-distinction to the chronic nephritic cases are absolutely normal. Some of these cases, if carefully handled, can go through pregnancy successfully. Whether this group is a distinct entity or whether these patients should be classed as persons who have not enough kidney function or reserve to stand the extra load of pregnancy is open to discussion, some feeling that this should be a subdivision of the cases of nephritis.

Danger of Permanent Visual Damage

Serious impairment of vision or blindness is a large price to pay for a baby that is quite apt to be dead. (Burnier reports an infant mortality of 79 per cent. in women showing extensive fundus changes.) The reality of danger to the mother is well illustrated in the following:

Burnier reports 44 per cent. of the women with retinitis as being blind or having greatly reduced vision, the mortality being 13 per cent. In Silex's series, *only 65 per cent.* of the patients with retinitis *had sufficient vision to permit reading.* Rochon-Duvigneaud's statistics showed 28 per cent. with normal vision, 58 per cent. with definite visual damage, and 14 per cent. blind. In Schiotz series of forty cases, 14 patients had normal vision, 18 had diminished vision and 1 was blind. The onset of fundus changes may be insidious with practically no subjective symptoms yet extensive damage occur before the macular region is involved and central vision practically obliterated. If one waits till the patient complains of greatly damaged vision, one is taking unwarranted chances for cases of retinitis have been reported with negative urinary findings. Practically what it amounts to is that if a *toxemic patient shows a retinitis*

fairly early in pregnancy, you can be reasonably sure that she will have very badly damaged vision if she is allowed to continue the pregnancy and does not abort spontaneously. If the retinitis comes on in the last week or so, the prognosis is better and the fundi will probably clear up after delivery ; but even in these cases the fundi and vision should be carefully checked up and labour induced if necessary. Therefore, the following conclusion seems logical, namely, if a toxemic patient shows a retinitis, the chances are four to one that she has nephritis, and should be carefully followed up for over a year, not being placed in the acute toxemic class and allowed to become pregnant again, unless urine, blood pressure, etc., were absolutely normal during this year. The immediate prognosis for life of patients showing retinitis is bad in many cases. If properly handled, the nephritic patient may live for years, but in the long run the prognosis is poor. If the retinitis persists for a considerable period, post partum, the prognosis is naturally worse.

Treatment of Patients with Retinitis

There is, of course, no absolute criterion, and every case should be judged on its own merits; but, in general, *if the retinitis is discovered at any time previous to the last two weeks or so of the pregnancy, the pregnancy should be terminated.*

Most of the women having marked hypertension show a narrowing and tortuosity of the arteries with slightly increased brilliance of the light streak. This is especially marked in the smaller arteries, around the disc, and in the macula. In short, if seen in a person of 60 years or more, these changes might be classed as "normal for age." In young adults in whom they are found they are distinctly abnormal and are, I feel, due to a functional vaso-constriction. The hypertension is the essential factor, and it makes no difference whether the cases are of acute toxemia or nephritis.

As a rule, the retinitis of the acute toxemia of pregnancy is an acute toxic rather than a vascular affair. Fundus changes vary from oedema of the retina, hemorrhagic retinitis to complete separation of the retina. In the nephritic cases the vascular changes predominate, namely, tortuosity or narrowing of the vessels with hemorrhagic or white spots, due to former hemorrhages, and the typical albuminuric retinitis picture is present. This is due to a chronic process antedating pregnancy. Thus, theoretically, it should be easy to differentiate between the acute toxemia and the chronic nephritis by the fundus picture alone; but, practically it cannot be done in the majority of cases for the following reason: If the pre-existing chronic nephritis was not severe enough to cause vascular changes, as is often the case, the sudden flaring up of the nephritis caused by the extra burden of pregnancy will show *more the acute toxic type of fundus picture*, and the chronic vascular changes will not be found. In the rare cases in which the vascular changes are found, however, by

the fundus picture alone, one can make a definite diagnosis of chronic nephritis, and according to Greenwood, the probable life of the patient will not exceed two or three years. At the risk of repetition, it should be remembered that if retinitis is present there is a four to one chance that the patient has nephritis.

The routine examination of the fundi is of distinct value to the obstetrician. It has been asserted that, if properly handled, cases of toxemia should not be allowed to progress to the point at which extensive fundus changes appear, and the fundus changes are, without doubt, found only in the extreme cases. In toxic cases where the question of terminating the pregnancy is in doubt the fundus findings can frequently be the deciding factor.

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J. MARKOWITZ

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COURSES FOR GRADUATES AND PRACTITIONERS

The Faculty of Medicine of the University of Toronto wishes to draw the attention of graduates and practitioners of Medicine to the fact that they may register as Graduate Students and attend any of the lectures, clinics (in-patient and out-patient) ward rounds or other classes of instruction given to the senior undergraduate students. The post-graduate student may devote his time to the instruction in any one department or to as many as he may so desire. Courses to the final year are given in Medicine, Surgery, Obstetrics and Gynaecology, Ophthalmology, Oto-Laryngology, Paediatrics, Dermatology and Genito-urinary Surgery. All the library facilities of the University are available to such post-graduate students.

The University imposes a minimum fee of $10.00 per month for registration and attendance under the above conditions.

TWO COMMON FRACTURES

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In the course of the routine daily work in a large Radiological and Physio-therapeutic Department, one has the opportunity to observe some points of interest regarding certain simple, or at least very common, fractures and injuries about joints. A few of these appear to be fundamental, and yet are not infrequently overlooked. No apology should be necessary, therefore, if emphasis is placed upon certain very homely facts. The present paper will be limited to Pott's fracture and Colles' fracture.

Pott's Fracture

Without entering into an academic discussion as to what Potts originally described, it may be stated briefly that the common injury about the ankle which is included under this term, consists of three factors:

1. A fracture of the external malleolus.

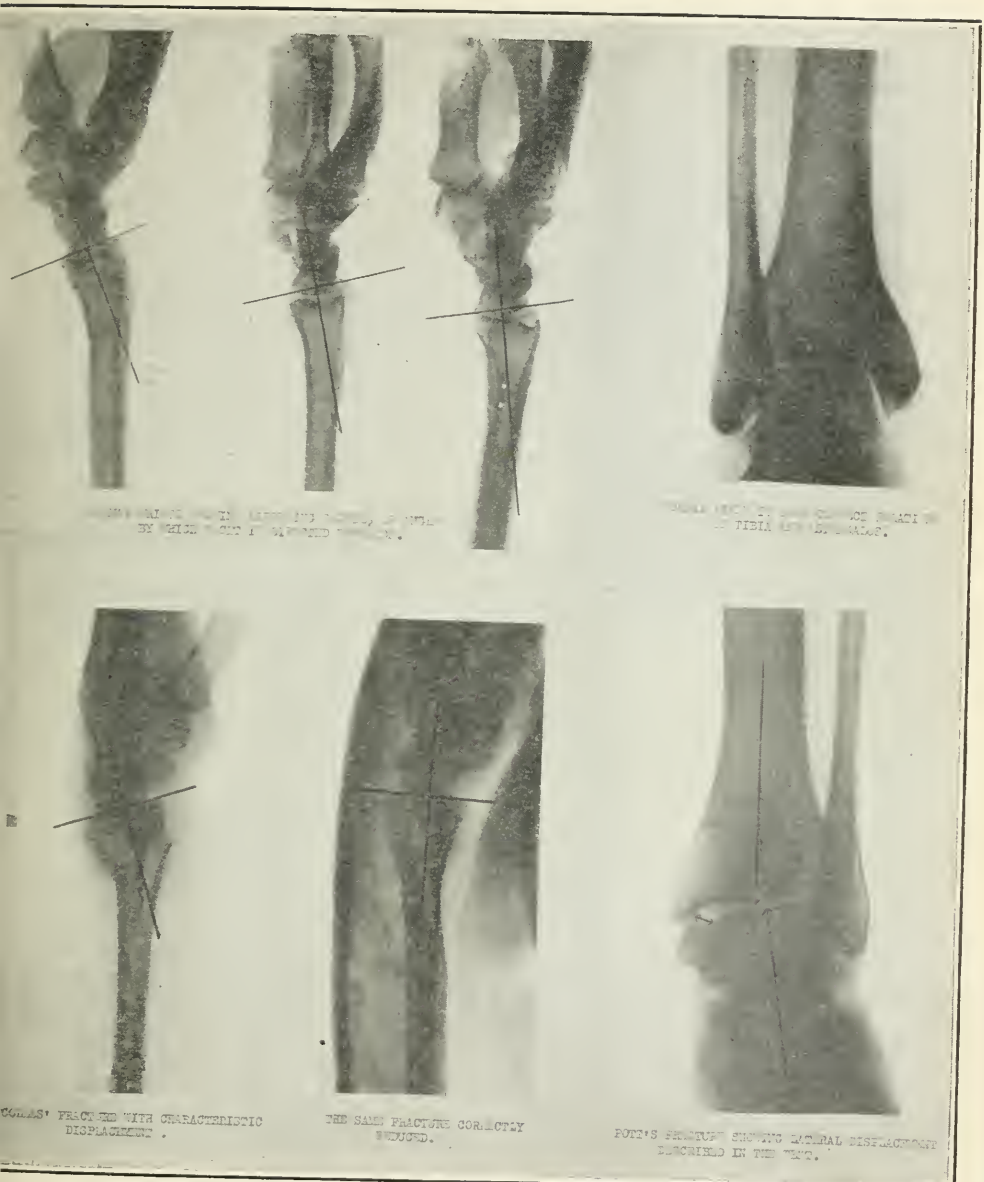
2. A fracture of the internal malleolus.

3. A semi-dislocation outwards of the foot in relation to the lower articular surface of the tibia.

It matters little how much attention is paid to the correction of the two former if the latter is left undiscovered or, if discovered, is not adequately and completely corrected. Since it is one of the commonest of fractures, it is somewhat surprising to observe the frequency with which this phase of the condition is overlooked. We have used the term "semi-dislocation", and yet this wording does not accurately describe the displacement which occurs. This may vary from an exceedingly slight lateral slip which does not measure more than an eighth of an inch, to a degree of displacement in which the centre of the astragalus is well over to, or even beyond, the external edge of the articular surface of the lower end of the tibia. We are scarcely concerned here with the latter, since a displacement so obvious is not likely to be overlooked. But in those in which the slip has been slight only careful examination of the X-ray plates will reveal the true state of affairs. For this purpose the most useful X-ray examination consists in single antero-posterior and lateral plates, the greatest care being taken to ensure that the tube is centred exactly over the ankle-joint, and that there is no rotation of the limb as the exposure is made. Under normal conditions in such a plate, a line drawn vertically downwards through the shaft of the tibia and through its lower articular surface will pass also through the centre of the upper articular surface of the astragalus.

If there is lateral displacement present this fact may be recognized by a study of this simple point and one other, namely, the spacing which exists between the inner malleolus and the adjoining portion of the astragalus. Normally these surfaces are separated only by the cartilaginous surfaces covering them, and this appears on the plate as a thin space not more on the average than 1/16th inch. If this space is definitely wider than this it may be considered evidence of some lateral slipping. In any doubtful case it may be well to examine the opposite joint. If the slipping amounts to ¼ inch, as very often is the case, and this displacement remains unreduced, the result will almost invariably be a stiff, painful ankle, with some degree of limitation of movement. Furthermore, if the displacement is not recognized until several weeks have elapsed, the space fills in with organized exudate or fibrous tissue to such an extent that complete correction later will be exceedingly difficult, and may be impossible.

For this reason it is most desirable that an X-ray examination should be made immediately after the reduction, even if this has been done under fluoroscopic control. In the vast majority of cases the two *fractures* which are present are correctly dealt with, but in a certain number the third factor will be overlooked unless it is deliberately sought for and corrected.



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[illegible] OF TIBIA [illegible].

COLLES' FRACTURE WITH CHARACTERISTIC DISPLACEMENT.

THE SAME FRACTURE CORRECTLY REDUCED.

POTT'S FRACTURE SHOWING LATERAL DISPLACEMENT DESCRIBED IN THE TEXT.

In this case also there are certain facts which may be regarded as fundamental. For our present purpose the chief interest centres in a study of the lateral projection of the lower end of the radius as it is seen normally, and in a Colles' fracture. A series of wrists were examined and a few of these are shown in the illustration. In the majority it will be seen at once that the lower end of the radius bearing the articular facet is directed slightly forwards, and if a line is drawn joining the two points of this articular surface, and then from the centre of this a perpendicular is erected, it will not pass up the centre of the fore-arm as is commonly supposed, but will emerge through the back of the wrist. The exact angle thus formed varies slightly with individuals, but generally is found to be from three to ten degrees *forward*.

In a typical Colles' fracture the small lower fragment is displaced backward, and the long upper portion of the shaft is impacted into it in greater or less degree. This in turn is the cause of more or less comminution on the dorsal aspect.

The necessity of disimpacting these fractures has been taught for many years, and is only referred to here in order that the urgency of this procedure may be again emphasized. If the impaction be allowed to remain, the result will almost always be a stiff painful wrist with limitation of dorsi-flexion, just as in the ankle, failure to correct the lateral displacement results in a persistently painful joint.

The ideal reduction, of course, would include complete anatomical restoration of the parts, and in this case requires that the lower fragment be replaced in such a manner that the articular surface is again directed forwards three to ten degrees. That this has, in fact, been accomplished, can only be determined by subsequent X-ray examination (even if the reduction here also has been done under fluoroscopic control). We repeat this adomínition because of the frequency with which we are asked to omit this re-examination and trust to the fluoroscope. The latter is exceedingly useful, but is not sufficiently accurate in matters of such fine judgment, and even if this were true the fluoroscope leaves no permanent record. It is important for all concerned that there be a permanent record of the fracture as it was at the completion of the reduction as well as before.

DIAGNOSIS AND MANAGEMENT OF THE OCCIPITO-POSTERIOR POSITION

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One of the most frequent causes of difficult and delayed labour, met with in general practice, is the occurrence of an occipito-posterior position of the child. Indeed it occurs more frequently than is suspected because of the fact that a large proportion of these cases will eventually terminate spontaneously, the occiput having rotated to the front either at the brim or after the head has entered the pelvic cavity. The factor that determines whether or not such a favourable outcome will supervene is the amount of flexion of the head. With good flexion the occiput is the most advanced part and will rotate to the front, usually after coming into the pelvis, but occasionally at the brim. When flexion is incomplete, however, the forehead becomes relatively the most advanced part of the foetus. The forehead is actually higher than the occiput, but the pelvic floor is higher in front than behind, therefore the forehead strikes the pelvic floor first and is rotated to the front. It is not alone due to the fact that the occiput is to the back that difficulty arises, but rather to the incomplete flexion which results in a larger diameter of the foetal head having to pass through.

On abdominal examination the back of the child is felt toward the mother's flank or is not felt at all. The breech is felt at the fundus, but, on tracing it downwards the fingers dip into a hollow between it and the head at the brim, in which the small parts are felt. The head is usually unengaged and the forehead may be felt above the pubic ramus on the side opposite to the occiput. The foetal heart is heard deeper in the flank and not as distinctly as in the anterior positions. In this connection, however, one should remember that occasionally the deflexion of the child results in the chest or shoulder coming close to the surface on the opposite side; and in such cases the foetal heart may be heard quite distinctly on that side and towards the front, and may lead to errors in diagnosis, the case being mistaken either for an anterior position or for a face. Internal examination, at the beginning of labour, reveals a head that is high up with the sagittal suture in one of the oblique diameters and the large fontanelle anteriorly. It is often difficult to feel the posterior fontanelle at this time because of the incomplete flexion. One should also remember that in many of these cases the head enters the brim through the transverse diameter. Another feature sometimes discovered is the fact that the presenting head seems crowded to the front

against the pubic arch and there is plenty of space between the head and the sacrum. After descent is started these findings are somewhat changed, because the increased flexion brings the small fontanelle near the centre of the pelvis. It is then easy to make out both fontanelles. The large caput which is usually present may make the identification of the fontanelles difficult and in such cases the easiest way to make an accurate diagnosis is to pass the hand up until one feels an ear.

Labour in occipito-posterior cases is nearly always longer, harder, and more painful and this is due to a variety of causes; the cervix is slow in dilating and dilatation may remain incomplete for a very long time, and there is usually early rupture of the membranes and the failure of the head to come down normally adds to the delay. If rotation to the front occurs spontaneously the occiput has to travel through 3/8 of a circle instead of the normal 1/8 of a circle. Engagement of the head is slower because the broad part is likely to impinge on the promontory of the sacrum.

Usually when labour begins with a posterior position, anterior rotation occurs, and the delivery terminates as an occipito anterior, but in a certain percentage of cases the occiput remains to the back and various causes have been brought forward to account for these cases, some of which are: minor degrees of flat pelvis, pendulous abdomen, a large pelvis with a small child, exhaustion of the uterine powers before the rotation is complete, a "funnel pelvis", or an abnormal pelvic floor. Whatever combination of circumstances brings it about, however, the essential factor is the incomplete flexion of the foetal head.

There are two varieties of occipito-posterior cases; those where the head remains high up and will not engage and those where the head enters the pelvis, but in which the occiput remains to the back. The first of these is rare and labour may reach an impasse, and in some instances a brow presentation develops as a result of increased extension. In the second type the occiput enters the pelvis either in the transverse or oblique diameter, and then either rotates backward to the hollow of the sacrum or comes forward as far as the transverse diameter where it stops, the so-called "deep transverse arrest".

The treatment of occipito-posterior cases is essentially expectant, especially during the first stage of labour. As we have pointed out, this stage may be a very long one, and although measures may often be taken for the relief of pain no attempt at delivery should be made until the cervix is entirely out of the way. One should take every precaution possible to try to prevent rupture of the membranes. The patient therefore, should be in bed, internal examination should be avoided and when necessary performed gently, and any ill-advised efforts of the patient toward bearing down should be discouraged. If this stage of

labour is so prolonged that the patient becomes exhausted, or nervous and hysterical, it is advisable to give her two or three hours' rest by the use of sedatives, an efficacious form being morphia grain ¼ and hyoscine gr. 1/100. Rectal anaesthesia carried out in the so-called "synergistic" method often works very well. If one always waits until the cervix is fully dilated before interfering in occipito-posterior cases one will find that by the end of the first stage a large proportion of them have already rotated to the front or give indications of so doing. After complete dilatation of the cervix opinions differ as to the best course to be pursued. The teaching of the Rotunda Hospital, Dublin, is that even in cases of persistent posterior positions it is best to do nothing unless evidence of foetal distress or danger to the mother's life arises, and in either of these events they teach a forceps delivery without correcting the malposition. Other teaching centres, however, have different views. It is our opinion that a policy of expectancy should be carried out during the first stage, even if long delayed. In those very rare cases where the condition of mother or child warrants, a hydrostatic bag may be used to aid dilatation. We do not believe in attempts at manual dilatation. After the cervix is completely dilated, if the head is engaged and progress is being made, we still believe in leaving the case to nature. Under such circumstances if the uterine contractions become weak or irregular the use of small doses of pituitary extract is justifiable. If no progress is being made after a reasonable length of time in the second stage we believe in trying to assist delivery. We interpret a delay of two hours without any progress as being a reasonable length of time. If the head is engaged we attempt to rotate the occiput to the front. Occasionally the simple manoeuvre of Hodge, pressing on the sinciput during the pains and thereby promoting flexion, is of value. Usually, however, our assistance takes the form of a manual rotation followed by a forceps delivery. This manual rotation is performed by putting the hand in the vagina, displacing the head and, reaching the posterior shoulder of the child, moving it toward the front, followed by a rotation of the occiput to the front. The hand is left in the uterus, retaining the head in position, until the first blade of the forceps is applied. In those few cases where the head has remained floating after complete dilatation of the cervix and where further extension is taking place a version may be required. The primary cause of difficulty here, however, is, in all probability, a contracted pelvis and the probabilities of a living baby being delivered are not great, especially in primiparae.

RECENT ADVANCES IN THE PHYSIOLOGY OF URINARY SECRETION

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In discussing the mechanism for the formation of urine, it is customary to enunciate three theories of renal secretion:

(a) *Bowman and Heidenhams theory* states that the glomerular capsule permits the transudation of water and readily diffusible salts, and the tubules add the other organic and inorganic constituents found in the urine. The kidney thus manufactures urine just as the pancreas makes pancreatic juice. Water on its way from blood-vessels to gland lumina, picks up the products of secretion by certain specialized cells.

It is practically certain that this view in its entirety is incorrect. The theory, when postulated, had little more than anatomical evidence to support it. The onus of disproving it rested, therefore, with those who assailed it. By imagining various functions to reside in different parts of the glomerulus and tubule, the adherents of this theory had enough permutations and combinations to explain all the known abnormalities in the composition of the urine. It is probable that there is some truth in this hypothesis, as a certain amount of evidence exists that the tubules may secrete material into the lumen. The theory has many serious objections. Even the grosser details are nebulous, ascribing as they do, mathematical intelligences and powers of minute discrimination to individual cells. It is correctly designated, therefore, as the *vital* theory.

(b) *Ludwig's theory* for a considerable time rivalled that of Bowman and Heidenham. It held that the capsule of Bowman was merely a filter which allowed plasma, minus its protein, to filter through. In the tubules this dilute filtrate was concentrated, the bulk of the fluid returning to the blood by a process of diffusion. No known physical force, however, can form from blood plasma a fluid of considerably greater osmotic pressure, like urine. This theory of Ludwig's has served, in consequence, as a scaffold for what Cushny calls, the *modern* theory.

(c) *The modern theory.* Realizing that the physical factors alone will not account for reabsorption in Ludwig's theory, the modern theory is compelled to resort to a vitalistic concept. According to this theory the formation of urine is a dual affair, each moiety of which differs in mechanism and in location. The glomerulus functions passively as a filter, the filtrate consisting of deproteinized blood plasma. The filtrate is a sort of Locke's solution, and in its passage down the tubule becomes concentrated by a *selective, vital activity* of the tubule epithelium. Those constituents which are not reabsorbed, irrespective of their concentration

in the glomerular filtrate, are termed *non-threshold bodies.* On the contrary, those which are reabsorbed only when they exist below a certain concentration in the filtrate, are termed *threshold* bodies. Urea is an example of the former, glucose of the latter. The teleologist would enunciate the theory differently: The kidney tubule rejects substances which are of no use to the organism, reabsorbing those which the blood requires to keep its composition constant. Although the meaning of these two propositions is identical, the less one ascribes cognate sensibilities to renal units, the clearer will be our conception of the *modern* theory. For example, egg-albumin when parenterally introduced into the organism is promptly excreted. The glomerular capsule is evidently permeable to egg-albumin. This is preferable to saying that the glomerular capsule senses the difference in composition between blood albumin, and egg albumin, and rejects the latter. In seeking to explain natural phenomena, Socrates admonished that we omit the gods. We must be careful not to relegate these gods to individual cells, who may, as it were, act for them by proxy.

According to this theory, then, *threshold* bodies are reabsorbed in definite proportions, which are determined by their normal concentration in the blood. When the concentration of sodium chloride in the blood is low, as in lobar pneumonia, acute rheumatic fever, almost no chloride appears in the urine; when the concentration of sugar in the blood is high, sugar appears in the urine.

The modern theory has recently received its best confirmation at the hands of Richards, and his colleagues, at the University of Pennsylvania. Their methods were prompted by the investigations of Krogh on the capillary circulation. Krogh focused a powerful beam of light on the resting muscles of frogs and guinea-pigs, *in situ.* The illumination so obtained was sufficiently powerful to enable him to observe the behaviour of the capillaries with a binocular microscope. It occured to Richards and his collaborators that the use of the same method might enable them to see the glomeruli of the kidney in operation, providing that they could find a kidney sufficiently transparent to permit the penetration of light rays, The frog's kidney fulfilled this demand, and the results obtained by this method have been very important.

They found that the blood flow in a given glomerulus was not continuous, but intermittent, so that a glomerulus would pulsate for fifteen seconds or so, and then be quiescent for a corresponding length of time. Two adjacent glomeruli could be situated within a few microns of each other, and yet the blood flow in one could stoy completely, with no perceptible alteration in the blood flow of the other. This phenomenon of intermittence is a peripheral affair, as it persisted after destruction of the brain and spinal cord. Krogh found that when blood ceased to flow

through a given capillary, it disappeared from view. The Pennsylvania workers found that when the blood flow stopped abruptly in a single active glomerulus, the corpuscles would stagnate for an instant, and then disappear. It is possible that glomerular capillaries are under a similar regulatory influence to capillaries in general. If so, a relationship may at last be established between certain forms of hypertension and alterations in kidney structure.

It follows from the above discussion that all the glomeruli do not function at once. The number of glomeruli acting at any given moment may determine the extent of kidney damage inflicted by circulating toxins or organisms.

They found that substances which depress the circulation, such as pressor doses of adrenalin or pituitrin lessen the number of glomeruli that are active. Substances which stimulate the circulation, such as hypertonic saline, caffeine, increase the number of glomeruli that are active with consequent diuresis. At least one variety of diuresis is, therefore, due to increase in the number of acting glomeruli. Small doses of adrenalin decrease the flow of blood through the rabbit kidney, increase its volume, and increase the volume of urine. This triad is explicable by assuming that adrenalin acts on the efferent glomerular vessel, and this constitutes another variety of diuresis.

By introducing a capillary pipette into the capsule of Bowman, Richards and Wearn collected a sample of glomerular filtrate. It contained urea, sodium chloride, and glucose in approximately the same concentration as in the blood. Bladder urine collected at the same time contained no glucose, and under certain circumstances, no sodium chloride. The *modern* theory thus receives striking confirmation. The work of Bieter and Hirschfelder, who employed the same technique, confirms the view that urine is excreted in dilute form through the glomeruli, and concentrated by the tubules.

Assuming that these results obtained in the frog hold good in the human, it follows that the human kidney is not one single structure, but a composite organ, and like the eye of a fly, consists of many individual units. A human kidney contains approximately two million glomeruli, and the daily twelve hundred cubic centimetres of urine are probably formed by four million little kidneys. This conception is quaint as well as epoch making, and promises much in our interpretation of renal pathology.

The student is referred to the following references:

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THE TREATMENT OF TUBERCULOUS ABSCESS AND SINUS

Clarence L. Starr

The tuberculous abscess, so frequently associated with tuberculous disease of bones and joints, is usually looked upon as a mere adjunct or complication of a serious condition, and its treatment therefore is not considered carefully. As a matter of fact the abscess should be treated as the gravest element in the disease, because it is from this source for the most part that other organisms are introduced, and the added infection is the cause of the largest percentage of the mortality in this disease. The tubercle bacillus is now looked upon as an organism of low virulence for the bulk of people with an average resistance, but as soon as the disease has added another infective organism, the outlook is changed and the mortality is tremendously increased. It is a fair estimate that well over ninety per cent. of all cases with pure tuberculous infection of bones or joints get well, with greater or less loss of function. It is equally true that a very large percentage of the cases with mixed infections do not recover. The mortality from the pure tuberculous infection is mostly from invasion of other tissues, usually the central nervous system or kidneys, whereas the cases with mixed infections die of amyloid disease of the abdominal viscera or from exhaustion from long continued suppuration.

In a paper before the American Orthopedic Association in 1901 the writer made the statement that no case of amyloid disease had ever been seen with a simple tuberculous infection, and at that time it was a common condition due to the prevalence of mixed infection from faulty methods of dealing with tuberculous abscesses. From a wide experience since that time the statement has been proven true, and now in a very large clinic it is quite rare to find amyloid disease, due undoubtedly to the fact that every precaution is exercised to prevent mixed infections.

In most text-books at the present time very scant instructions are given as to the method of caring for tuberculous abscesses, and the dangers of mixed infections are nowhere emphasized sufficiently. The method of dealing with septic abscesses, on the other hand, is adequately stressed, and the average young practitioner makes the mistake of treating both alike, with very serious detriment to the tuberculous case. In 1890 Mr. Watson Cheyne recommended the complete excision of the abscess in tuberculous bone disease. This would be an ideal method if it were generally applicable. Unfortunately its use is very limited and has never been considered of real value in dealing with the problem in a large way.

Expectant Treatment.—It is urged that the abscess is an extension from a primary bone focus, and as the disease is progressive the abscess will recur if the contents are removed. This is only partially true. The abscess develops by the caseation and liquefaction of a tuberculous

focus in bone, and as the degenerative process spreads in the bone this liquefied material breaks through and extends into the soft tissues. It extends in the line of least resistance and is known to do so for great distances from the primary focus. As it continues to enlarge, almost the entire contents are broken down debris of bone and invaded soft tissues, and the wall is a granulation wall, the so-called "pyogenic membrane" of earlier writers. This granulation wall varies in thickness, but in it is found the active tuberculous process. Numerous pathological tubercles can be demonstrated and here the tubercle bacilli are found abundantly. The liquid contents of the abscess contain in many instances no bacilli, or at any rate very few. The expectant treatment is really a patient waiting to observe the progress of the abscess under careful and efficient treatment which is especially directed to the treatment of the local focus. In a fairly large number of cases the abscess will recede rather than progress under these circumstances.

In the mind of the writer the efficient treatment of the local condition means recumbency with protection from movement as largely as possible, and entire protection from weight bearing during the active stage. This means twelve to eighteen months on a frame or splint in the case of the spine or hip disease, and a correspondingly shorter period in the case of the knee or smaller joints. The general treatment of the patient consists in careful and abundant nourishment of an easily assimilated kind, with a free administration of fruits and green vegetables, good hygienic surroundings, and heliotherapy. Even in a rigorous climate exposure of the patient to the sun's rays after the plan of Rollier can be carried out for at least six months of the year, and the mercury quartz lamp is found to be a useful adjunct during the extreme winter months. If the abscess progresses steadily in spite of careful treatment, and gradually works closer to the surface, it is questionable whether it should be left alone longer. If left, it will gradually invade the skin, and this tissue will become tuberculous and the abscess may become infected with skin organisms, chiefly staphylococci, from the sweat glands which harbour them. The granulation layer formed on the under surface is undoubtedly a partial safeguard, and the skin may break through and the abscess contents be discharged without mixed infection of the cavity.

Aspiration.—If it is decided that in such a progressive abscess interference is necessary aspiration is often considered the safest means of treatment. There are several difficulties which will be encountered. First, the contents of nearly all such abscesses contain, in addition to the "whey" or definitely liquid portion, a fairly large proportion of "curd" or semi-solid debris which will not pass through even a very large bore aspirator. Hence it is found that repeated attempts at aspiration fail because of plugging of the aspirator needle. Again, even if partially successful, and the tension of the abscess is relieved at least for a time, there is a real danger from withdrawal of the needle that tuberculous material will be lodged in the track and a real tuberculous

sinus result. This is frequently the case if the needle is plunged into the abscess in its most prominent and usually thinnest part; it is sometimes prevented by introducing the needle obliquely from a distance, penetrating a fairly thick section of skin and muscle tissue before reaching the abscess cavity. There is also a further difficulty in the location of some of the abscesses, and it often entails a degree of courage bordering on foolhardiness to attempt to aspirate a psoas abscess under certain conditions. After all these factors have been considered, however, there is no doubt that a certain few cases of abscess may be treated successfully in this manner.

Aspiration and Injection of Antiseptics.—In the view of the writer, the added injection of any antiseptics after partial aspiration of an abscess is of very doubtful value theoretically. It does not sound reasonable to expect any effect on the protected organisms of the granulation wall of an abscess cavity when antiseptics are injected into, and diluted by, the fluid contents of such an abscess. In some clinics the injection of naphthol or of iodoform and glycerine has been used extensively, and the results, on the whole, are not as good as by the expectant method. Iodoform has been demonstrated of very little value in local applications to tuberculous processes, and when glycerine is added it destroys what little value the iodoform possessed. Since the glycerine is hygroscopic, serum rapidly fills the cavity which was partially evacuated by aspiration, and the danger of sinus formation along the track of the needle is increased. It is our opinion, therefore, that the injection method has no place in the treatment of these abscesses.

Incision.—It is so easy for the practitioner to fall into the error of thinking that tuberculous abscesses should be dealt with by the recognized method of treatment of "septic" abscesses, that is, they should be opened at as early a date as possible, and so as to ensure efficient drainage in the most dependent part. This method of early incision and dependent drainage, particularly when a rubber tube or similar drainage method is used, is in the great majority of cases the most likely to lead to disastrous results. Unless the incision is made under the strictest aseptic precautions and the drainage material removed within forty-eight hours, secondary infection is almost sure to supervene.

Incision with Closure of the Wound.—While the writer was serving an eighteen months' interneship in one of the New York Hospitals he was impressed with the very large percentage of cases with tuberculous abscess which became secondarily infected, and the dreadful emaciation and gradual exhaustion which followed. Amyloid changes in the abdominal viscera were also of frequent occurrence. A visit during the next year to many European clinics further impressed this fact, as similar conditions were found there. In 1901, at the American Orthopedic Association, the writer presented a short paper on the treatment of tuberculous abscesses by incision, cleaning out the granulation wall, and closure. The paper was based on thirty cases so treated, with

primary healing in over ninety per cent. of cases and no secondary infections. This paper created a good deal of criticism, and showed that the older members especially had become so accustomed to the then existing condition that they accepted it as a matter of course. In 1907, at the meeting of the British Medical Association in Toronto, a further report was made of cases treated up to that time with similar findings. After an experience of about twenty-five years as a member of the Staff, and for many years as Surgeon-in-Chief of the Hospital for Sick Children in Toronto, the writer looks back with some pride at the changed conditions in regard to tuberculous bone diseases, especially with regard to the very small number of cases of mixed infections. At the present time it is rare to find a case of mixed infection in this clinic, and amyloid disease is practically unknown. With this change it is also noted that very few cases of tuberculous meningitis are found following bone tuberculosis.

The routine technique followed for many years with regard to tuberculous abscess is to follow the case expectantly, treating the bone lesion and carefully watching the abscess. In a fairly large and gradually increasing proportion of cases the abscess subsides, and in process of time becomes a thickened or calcified mass in the region where the abscess was present. The X-ray will often verify these findings. As in tuberculous tissues anywhere in the body the cure of the lesion is by a substitution of fibrous tissue or calcareous deposits, it is assumed that in the case of the abscess a real cure has resulted.

Surgical interference is advised in the cases where, in spite of careful treatment of the original bone lesion, the abscess gradually increases in size and ultimately threatens to invade the skin. After careful preliminary preparation of the skin an incision is made large enough to explore the cavity thoroughly. This incision is made in the least dependent area and through healthy tissues, often at quite a distance from the abscess cavity, so as to insure a thick layer of muscular tissue between the abscess cavity and the skin, and to prevent the filtering down of any remaining tuberculous organisms by gravity into the line of the incision which would result in a tuberculous track or sinus. As soon as the cavity is opened a "sucker" is inserted and the contents aspirated to prevent soiling of the wound as far as possible. The cavity is then opened widely, carefully retracted, and the entire granulation wall cleaned out with gauze sponges or iodoform gauze. The bleeding is controlled by pressure and the entire cavity is swabbed out with $2\frac{1}{2}\%$ iodine. The incision is then thoroughly mopped with alcohol to clear out any debris and the deep structures brought together with interrupted catgut sutures. The fascia is closed with continuous catgut suture and the skin closed with horsehair. Pressure is maintained where possible during closure of the wound, to prevent filling with serum, and a heavy pad or dressing applied with an elastic flannel bandage. The great majority of these wounds heal by primary union. In a few

instances a second operation is found necessary, and in a few cases aspiration is resorted to if the cavity rapidly fills up and endangers the suture line. In most cases there is a moderate refilling of the cavity with serum, but this is soon absorbed. After these many years of experience it has not been found that this radical cleaning out results in spread of tuberculous disease to other distant tissues.

This method has been practised in many other clinics since first advocated by the writer, and in some the results have not been nearly so satisfactory as in our own clinic. Investigation has shown that the fault has been for the most part due to careless technique, particularly in the failure to make the incision through as wide an area of healthy muscular tissue as possible, to place a wide barrier between the cavity and the skin surface. This method is still recommended as the method of choice in dealing with this troublesome complication.

Sinuses.—The treatment of tuberculous sinuses is still a matter of controversy. There are no doubt a large number of cases of abscesses treated expectantly, which ultimately rupture and discharge their contents and do not become infected. This is especially true in some of the institutions where heliotherapy is the chief or sole method of treatment of tuberculous disease. It was the writer's privilege a short time ago to visit such an institution, and it was rather a surprise to see so many cases with sinus, and apparently none of them more than superficially infected. The method adopted for treatment of these conditions in our clinic is first to absolutely prohibit any medical officer or nurse to put anything into the sinus; no probe or drainage tube or attempt at irrigation or swabbing of the sinus is permitted. In the second place, dressings are done as infrequently as possible and at the same time keeping the area clean. When dressings are done the surface is wiped off with alcohol and a fresh dressing applied, preferably of some antiseptic gauze such as the double cyanide of mercury and zinc.

After a fair trial of many methods of dealing with such sinuses, as irrigation with saline, Dakin's solution, swabbing with zinc chloride or carbolic acid, these have all been abandoned, and the treatment as above noted has proven the most efficient. In the cases where mixed infection has occurred, adequate dependent drainage is essential, and in superficial lesions such as are found in the extremities, many of these can be cleared up in time. In the psoas abscesses with mixed infection, however, the writer has become definitely pessimistic. The difficulties of adequate drainage are so great that very few of them will recover, and the mortality is greatest among these cases.

BLOOD GROUPING AND THE SELECTION OF DONORS FOR TRANSFUSION

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Since the practice of blood transfusion has become a well recognized therapeutic procedure, the matter of the selection of donors for transfusion has come to be one of great importance. The idea of transferring blood from a healthy to an anaemic individual cannot be said to be of recent date, but the putting into practice of this idea was really only developed to any extent during the great war. It was chiefly during this period that various methods of technique were devised by which such a transfer of human blood from one individual to another could be accomplished with any degree of ease.

Unfavourable Reactions

With the wider application of this procedure, however, it was soon noted that while in the majority of cases the patients benefited by the transfusion, in other cases the results were not only disappointing, but occasionally, even disastrous. In some instances the condition of a patient instead of being improved as a result of the transfusion was rendered rapidly and decidedly worse; the outstanding symptoms in these cases being chills, coma, hemoglobinuria and shock. In other instances death would occur almost immediately after the introduction of fresh blood into the circulation of the patient. Occurrences such as this led some observers to conclude that there must be certain individuals whose bloods were incompatible. Previous to this, however, it had been shown that the red corpuscles of certain individuals would undergo agglutination, and later on hemolysis, when brought into contact with blood serum from other individuals.[1] This was at first thought to be a pathological condition associated with and peculiar to certain diseases. Later, however, it was shown [2], [3], [4], that this phenomenon could occur between the cells and serum of perfectly healthy individuals, and the conclusion was reached by different workers, chief among whom were Moss[2] and Jansky,[4] that all human beings fell into one of four groups, depending upon the reaction of their serum to the red cells of other individuals.

Four Blood Groups

These groups were numbered by both workers 1, 2, 3 and 4, but unfortunately their numbers do not represent the same groups in either case. This has led to a great deal of confusion, since one frequently sees references in the literature to certain blood groups with nothing

to indicate which classification is meant. The difference between the two types of classification is best illustrated by the following table:

TABLE I

Comparison of the classifications of Moss and Jansky

Moss Classification		Jansky Classification
Group I	=	Group IV
" II	=	" II
" III	=	" III
" IV	=	" I

For years the Moss classification was largely in use on this continent, but owing to the confusion arising out of the use of the two classifications, the matter was taken up by the American Association of Immunologists and the American Association of Pathologists and Bacteriologists;[5] and, because Jansky's work was published prior to that of Moss, it was decided by these bodies that the classification of Jansky be adopted. Unfortunately, however, many writers, not only on this continent but elsewhere, have not yet fallen in line with this decision, with the result that a great deal of confusion still exists. At the Hospital for Sick Children we have been using Jansky's classification for four years, and that is the classification which will be used throughout this paper.

The distribution of the various groups among the general population seems to be fairly constant in America and Western Europe. In the orient, however, there appears to be a larger proportion of Group III than is found in this country. Our figures, based on grouping several thousand individuals, give the proportion in the various groups as follows:

Group	I.....	42%
"	II.....	40%
"	III.....	14%
"	IV.....	4%

The Agglutination Phenomenon

An attempt to explain this phenomenon of agglutination was made by von Dungern and Hirschfeld in 1911.[3] More recent work along this line using absorption of agglutinin tests, has confirmed the theory of these investigators. Briefly the explanation is as follows:

Certain blood serums contain substances which, when brought into contact with certain red cells, cause these cells to agglutinate. These substances are called agglutinins, they are of two types *a* and *b*. Certain red cells on the other hand possess the property of being agglutinated

by these agglutinins. This property is supposed to be due to the presence in the cells of a substance known by the terms agglutinogen, agglutinable body or receptors. We prefer the latter term. These receptors are also of two types and are here designated A & B. Using Jansky's classification, these agglutinins and receptors are distributed then in the blood groups as follows:

TABLE 2

Showing the presence in the various groups of receptors and agglutinins.

Group	*Cells contain receptors*	*Serum Contains agglutinins*
I	..	*a & b*
II	A	*b*
III	B	*a*
IV	A & B	..

Agglutination occurs only when corresponding agglutinins and receptors are brought into contact, *e.g.*, agglutinins *a* and receptors A as would be the case were Group III serum mixed with Group II cells. Obviously such a combination does not exist in the blood of any individual, otherwise auto-agglutination would occur.

"The Universal Donor" so-called

The matter then of four blood groups having been established, it was quite generally accepted that the majority of the unfavourable reactions previously reported were caused by the transfusion of incompatible bloods resulting in agglutination and hemolysis. There are those [6], [7], who believe and teach that evil results only follow when the corpuscles of the donor are agglutinated by the serum of the patient; and that while the cells of the patient may be agglutinated by the serum of the donor in the actual test, no ill effects would follow transfusion from such a donor, since the donor's serum is rapidly diluted as it enters the patient's circulation, and does not reach a sufficient concentration to agglutinate his cells. According to this doctrine, then, it should be quite safe to transfuse any individual from a donor whose cells will not be agglutinated by the patient's serum. By reference to Table 2 it will be seen that group I cells contain neither receptors A nor B and, therefore, cannot be agglutinated. For this reason, then, it is claimed that Group I donors can be used irrespective of the group of the patient, and thus to this group has been applied the term "Universal Donor". In my opinion it is most unfortunate that this term has found its way into the literature, since it is most misleading. It gives the impression, as many believe, that it is quite a harmless procedure to transfuse from this group to any other group. This is only partially true, and as partial truth at times is dangerous, it is well to pursue this matter a little further. This I will admit, that accidents

following transfusion from Group I to other groups are less likely to occur than if Groups II, III and IV were transfused to other groups; and further, I will admit that the dangers of transfusing Group I to other groups in adults are less than they are in children; but since perhaps more transfusions are carried out on children than on adults, and having seen two fatalities in rather close succession, with most intense hemoglobinuria, following a transfusion of Group I to Group II, I am not prepared to accept without reservation the unqualified statement, so frequently seen in the literature, that the blood of Group I may be given individuals in other groups with impunity. It is quite true that both of these cases were children in which, because of the relatively small volume of patient's blood to that of the donor (using only adults, of course), it is quite an easy matter to introduce the donor's serum in sufficient concentration to cause agglutination and hemolysis of the patient's cells. These accidents occurred about five years ago; and since that time I have made it a practice to supply only donors in the same group as the patient, and personally never use the term "universal donor" except to draw attention to the fact that, strictly speaking, he does not exist. It is well to remember that Group I Serum contains both *a* and *b* agglutinins, and that every time this so-called universal donor is used for a patient outside his own group, his serum possesses the property of agglutinating the patient's cells; and, if a sufficiently large transfusion is given, the results may be disastrous.

Technique of the Tests

While many methods have been advocated by which the compatibility of bloods may be determined, since this article is intended chiefly for the benefit of the practitioner to whom modern hospital facilities are not available, we shall describe only the simpler methods. For the sake of clearness, let us now rearrange Table 2, placing the serums (together with their agglutinins—the small letters) in the vertical columns, and the cells (together with their receptors—the large letters) in the horizontal rows, thus:

TABLE 3

	SERUM			
Cells	I a & b	II b	III a	IV
I	−	−	−	−
II A	+	−	+	−
III B	+	+	−	−
IV A & B	+	+	+	−

The + sign indicates agglutination. The − sign indicates no agglutination.

From this table is seen that whenever corresponding agglutinins and receptors are brought into contact, agglutination results: thus, if cells of Group II containing receptors A are brought into contact with serum of Group III, containing agglutinins *a*, agglutination results as shown by the + sign. A careful study of this table, however, will show that in order to determine the group of any one individual it is not necessary to have at hand known sera of all four groups. The only serum required is a known Group II and a known Group III; and the only information required is that contained in Table 3 in the two columns within the heavy lines, together with the groups of cells at the left hand. These two columns give us four different pictures depending upon the group of cells mixed with these sera. Thus, if no agglutination occurs when the unknown cells are mixed with the known sera, the patient tested is Group I. If agglutination occurs with III and not with II, the patient is Group II. If agglutination occurs with II and not with III the patient is Group III, and if agglutination occurs in both sera, the patient is Group IV.

Assuming then that one has at hand known II and III sera, the technique is carried out as follows:

(1) Mark off a clean glass slide into two divisions with a china pencil, calling the left side II and the right side III; also mark the slide with the name or initials of the individual being tested.

(2) Into division II place a large drop of serum II, and into division III, a large drop of serum III.

(3) Prick the finger or thumb, after cleansing with alcohol and, allowing the skin to dry, and with a very small platinum loop, transfer a small drop of blood (about the size of a pin head) into serum II and mix well.

(4) Flame the loop in a spirit lamp or gas flame, wipe the blood off the finger with a *dry* wipe, and, using a fresh drop of blood, repeat step (3), but in this case transferring the blood to Group III serum.

(5) To prevent evaporation cover the slide with a small inverted dish, and examine at intervals with the naked eye and hand lens, or with the low power of a microscope.

Usually agglutination, if it is going to occur, will be observed in a minute or two. It can be hastened by gently rotating the slide. Since, however, certain cells are agglutinated rather slowly, we have made it a rule not to give a final report until after 20 minutes have elapsed. At the end of that time, by reference to the central portion of Table 3, the group of the individual can be readily determined.

Should there be any doubt as to the grouping, the following procedure known as "cross-agglutination", may be carried out. Obtain from both patient and donor a small amount of serum, by collecting a little blood and centrifuging it, or allowing it to clot. The serum, which must be free from red cells, may be drawn off by a capillary pipette, and a drop transferred to a glass slide as in the original test. To the serum of the donor is then added a small drop of the patient's blood, and to the serum of the patient, a small drop of the donor's blood. If agglutination occurs in either case, that donor should be discarded and another sought.

The above technique is simple, and ordinarily requires only the following outfit: a few glass slides, a needle, a china pencil, a fine platinum loop, a spirit lamp, a hand lens, (or a microscope) a little alcohol and a few cotton wipes. In place of the needle can be substituted a fragment of a broken slide, and the platinum loop and spirit lamp can be replaced quite satisfactorily by a few toothpicks.

Preparation of Serum

In addition to the above outfit one will require, of course, a supply of known Group II and Group III serum. When, however, in the course of one's search for donors, individuals in these groups are found, a small amount of serum may be obtained from them and preserved for future use. A common method of preservation is as follows: allow the blood to clot, pipette off the serum and add to each c.c. of serum 0.1 c.c. of 1% phenol in normal saline. Put the serum into sterile vials, cork and dip the corked ends into melted paraffin. Serum preserved in this manner will keep for many months.

In conclusion we would say that it is not the purpose of this paper to go into the question of the possible existence of sub-groups within the four recognized groups mentioned above. A lengthy discussion of this subject will be found elsewhere.[8]

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HAEMATURIA

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IT cannot be too often repeated, that haematuria is a symptom and not a disease, the haematuria will cease spontaneously in the majority of cases, but the disease is too often an unrecognized renal or vesical tumor which is allowed to progress to a state where cure is impossible and even temporary relief uncertain. Very few patients fail to consult a physician on first seeing blood in the urine; we do justice neither to our patients nor ourselves unless we make every effort to arrive at a complete diagnosis on the earliest possible occasion.

The urinary tract is, for clinical purposes, conveniently divided into the upper tract comprising kidneys and ureters, and the lower tract consisting of bladder and urethra, the urethra is further divided by the compressor urethrae or "cut off" muscle into anterior urethra and posterior urethra, the bladder and posterior urethra being for practical purposes one cavity.

Haematuria may be "occult", that is, discernible only on microscopic examination of a sedimented specimen, or "ocular", that is, the blood is sufficient in quantity to discolour the urine and be visible to the naked eye, the colour may vary from a smoky urine to the colour of blood.

In a voided specimen an occult haematuria gives no clue to the site of the lesion, a little consideration will show that the reverse is true in ocular haematuria. When bleeding occurs in the kidney, the blood is extruded at the same time as the urine, is intimately mixed with the urine as it passes to the bladder, will remain so in the bladder, and when the patient voids the stream must of necessity be uniformly discoloured throughout the whole act of micturition; this is termed "intimate haematuria". If on the contrary, there be some lesion present, such as a papilloma, in the bladder, then when the urine is voided, the bladder will contract upon the growth and crush it, in its effort to void it, the growth will in consequence bleed, and the blood will be extruded with or after the last few drops of urine, producing a phenomenon conveniently called "terminal haematuria". Of course a bladder tumour or ulcer may at times break or ulcerate into a small blood vessel, giving a continuous stream of blood into the bladder which mixes with the urine as it collects there, and when the patient voids the stream will resemble that from a renal haematuria, but careful observation will usually show that after all the urine is passed the patient has considerable tenesmus and passes some pure blood, often accompanied by clots, from the emptied bladder.

The first step in examination should therefore be to have the patient void into two glasses, the bulk of the urine being passed into the first glass, this constitutes the two-glass test for blood. If the blood is terminal it will be confined to the last glass, and one considers the bladder lesions which might produce haematuria, acute prostatitis or posterior urethritis, acute cystitis (rarely a primary condition), stone, new growth, and enlarged prostate. A history of frequency and difficulty in an elderly man suggests enlarged prostate, rectal examination and estimation of residual urine is indicated. Urgency and frequency by day with pain referred to the tip of the penis suggests stone in the bladder, and terminal haematuria with little or no disturbance suggests an early growth. In the former case cystoscopy is indicated, in the latter it is imperative.

It is worth noting that haematuria in a patient with an enlarged prostate occurs more frequently with the adenomatous enlargement than with the carcinomatous; there are three or four large vessels in the mucosa passing between the trigone and the posterior urethra; as the adenoma grows and projects into the cavity of the bladder it stretches these vessels and they give way when the patient strains to void, a carcinoma starts as a rule on the rectal surface of the gland and cannot produce haematuria until it has reached the vesical surface of the gland and ulcerated.

It is not advisable to cystoscope patients with enlarged prostates as a routine examination, both the local and general condition of the patient may contraindicate it, at the same time one must remember that a carcinoma of the bladder may accompany an adenoma, or arise as an extension of a carcinoma of the gland. Furthermore, when an extensive carcinoma is present in the bladder, cystoscopy is impractical, attempts at examination only result in straining and bleeding and nothing can be seen. In these cases a cystogram may help, the bladder is catheterised and filled with an emulsion of bismuth in liquid petrolatum, stereoscopic pictures are taken and the emulsion allowed to run out, the bladder is then filled with air and pictures again taken, filling defects from growths of moderate or large size or from prostatic enlargements are clearly seen, as also are irregularities in the bladder outline produced by diverticula.

Finally in a few cases exploratory cystotomy may be required to establish a diagnosis.

Turning now to a case of intimate haematuria, we have to consider lesions local to the kidney which produce haematuria, and the various systemic diseases of which haematuria may be an incident. Microscopic examination of the urine may show in addition to the blood, many pus cells and no pyogenic organisms, we should at once suspect a tuberculous kidney. There may be many sharp envelope-shaped crystals of calcium oxalate, and perhaps the patient complains of pain in the kidney or along the course of the ureter, or burning in the urethra on micturition, and

enquiry as to diet may disclose a recent feast of strawberries. In any case the patient should be X-rayed for possible stone, the whole urinary tract on both sides should be taken, an oxalate stone throws the densest shadow, then phosphate and carbonate, while a pure uric acid or urate stone throws no shadow and can only be demonstrated by the X-ray as a filling defect in a pyelo-ureterogram. Fortunately pure urate stones are rare.

Apart from crystals, calculi and tuberculous lesions, it is remarkable how few renal haematurias show localizing symptoms, hence the term "symptomless haematuria". A growth in the kidney frequently forms quite a large abdominal tumour before the patient discovers its presence.

In the absence of localising symptoms, and if palpation of the abdomen is negative, it is of great help to cystoscope the patient before the haematuria has stopped. The ureteral orifices can then be watched and the blood stained efflux seen to come from one or both ureters. Should it be unilateral, a pyelogram should be made to discover a possible early renal tumour too small to be palpable per abdomen, this would show as a distortion or obliteration of one or more calyces. Care must be taken to distinguish between obliteration of the cavity and mere lack of filling due to faulty technique.

Although of necessity considerable stress has been laid on the use of the cystoscope in the diagnosis of the source of haematuria, it must not be considered the first step in diagnosis, the rotation should be, as in every other process, from the simple to the more complex method. History taking, clinical examination, and complete examination of the urine should invariably precede cystoscopy; particular attention should be paid to any special tests which may be indicated during the progress of the clinical examination, such as blood pressure estimation, red and white blood counts, etc. Many diseases not local to the kidney produce haematuria, arteriosclerosis, focal infections, haemophilia, scurvy, renal infarcts and pyaemic abscesses in the kidney, poisoning by certain drugs, such as mercury and turpentine, idiosyncracies for drugs as a rule harmless, such as hexamine. Haematuria may in rare cases be nothing more than a vicarious menstruation and finally, when after strict search, no cause can be found, we may term it "essential haematuria".

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THE AETIOLOGY OF ANAEMIA AND ITS IMPORTANCE IN DIAGNOSIS AND TREATMENT*

DUNCAN GRAHAM.

The careful correlation of symptoms and signs will ever remain the physician's most dependable guide in the diagnosis of disease. It is only with this information that more modern methods of diagnosis can be intelligently applied for the further elucidation of the nature of the condition present. Among the common signs of disease presented by patients is pallor. In certain cases its association with other signs or with certain symptoms, as in Addison's anaemia, makes a correct diagnosis reasonably certain. More often it is associated with symptoms present in a number of conditions, as weakness and lassitude, and an accurate diagnosis is impossible without further investigations. In this type of case the physician, having decided from an examination of the skin and mucous membrane that the pallor is due to a deficiency of haemoglobin, too often prescribes a tonic of iron and arsenic without a further investigation into the exact cause of the anaemia. As a result, many opportunities are lost for the application of more effective treatment.

Probably the chief contributing factor to this all too common practice of the symptomatic treatment of anaemia is our lack of knowledge of the processes at work in its development. Even with our present inadequate knowledge of the subject it appears quite clear that anaemia results from three main causes: loss of blood from haemorrhage, as in duodenal ulcer; increased destruction of red blood cells, as in haemolytic jaundice; or deficient formation, as in benzol poisoning. In every case of anaemia an attempt should be made to ascertain which or what combination of these main factors are responsible in its production and then determine, if possible, the more exact aetiology of the condition. Among important aetiological causes may be mentioned: haemorrhage, external or internal; infection, malignant disease; intestinal parasites; chemical poisons; and unknown haemolytic agents. By a careful history and physical examination it is usually possible to determine whether or not haemorrhage is the cause of the anaemia. From the appearance of the skin and conjunctiva, by the examination of the urine for urobilin, of the blood serum for the presence or absence of bilirubinaemia, as shown by the van den Bergh test, and from the haemotological characteristics of the blood, information is obtained which indicates the presence or absence of an anaemia due to increased destruction or to deficient formation of blood. In the examination of a blood smear the

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presence of red blood cells showing polychromosia and reticulation indicates immature cells and is a sign of regeneration on the part of the bone marrow. The absence of these cells in anaemia is good evidence of deficient blood formation.

Anaemia, the result of loss of blood and that following toxic doses of benzol, has been studied most carefully, both experimentally in animals and clinically in man. It may be of value for our present purpose to review some of these findings, as the information gained from these observations is of the greatest value in the better understanding of anaemia due to other agents. The site of formation of the red blood cells in adult life is the bone marrow, mainly the marrow of the ribs and the ends of the long bones. From this source the circulating blood is maintained normally with a fairly constant number of mature red blood cells. Here these cells live and function for about thirty days. Old and dying cells are being constantly removed, chiefly by the spleen, and replaced by mature ones from the bone marrow. If a small quantity of blood is lost by haemorrhage, internal or external, it is rapidly replaced by normal cells; with a more severe haemorrhage of 400c.c. or over, the loss is replaced in part by immature cells, some of which may be nucleated. After a short time, usually within three weeks, the immature cells disappear from the circulation, and normal conditions are re-established. Should the haemorrhage be repeated ever so often after immature cells disappear from the circulating blood, the anaemia produced is soon recovered from. But if it is repeated sufficiently often without allowing the blood to return to normal, the bone marrow becomes fatigued, as evidenced by the absence of immature cells in the circulating blood, and anaemia results from deficient blood formation, in addition to loss from haemorrhage.

In benzol poisoning an anaemia develops which is characterized by depressed blood formation from the onset. Examination of the blood shows a diminution in the number of red blood cells, the percentage of haemoglobin, absence of immature cells, decrease in platelets and in the number of granular leucocytes of varying degree dependent upon the severity and duration of the poisoning. As these effects are present from the beginning and affect the formation of all types of blood cells in the bone marrow, benzol may be considered as an agent primarily affecting the bone marrow, causing depressed formation, and, finally, partial or complete aplasia. The skin and conjunctiva are white; the urine is pale—urobilin absent; the van den Bergh test is negative—absent bilirubinaemia; the case shows all the characteristics of an anaemia due to depressed blood formation. Owing to the extensive use of benzol in industry, this type of anaemia is seen more often than formerly.

A similar type, commonly referred to as idiopathic aplastic anaemia, occurs. Although the cause is at present unknown, the knowledge

gained from the study of cases of anaemia following benzol poisoning makes it quite clear that the condition arises from the action of an unknown poison on the bone marrow, causing deficient formation of red cells, and later aplasia.

Although it is possible to produce experimentally by repeated bleedings at appropriate intervals an anaemia due to deficient blood formation, this rarely, if ever, occurs clinically; and where such a type of anaemia exists in a patient giving a history of haemorrhage, another cause must be looked for. It is not uncommon in cases of duodenal ulcer giving a history of repeated bleeding to find an anaemia of this type. Further investigation usually establishes the presence of a focal infection in teeth or tonsils as the probable cause of the depressed condition of the bone marrow. In pulmonary tuberculosis the toxic products of the tubercle bacillus affect the bone marrow depressing blood formation, and an anaemia of varying degree results. Should a haemorrhage occur, the severity of the anaemia is increased, but the marrow does not respond in a normal fashion with signs of active regeneration. The condition of the marrow at the time of the haemorrhage determines its reaction to the loss of blood.

In certain anaemias the skin and conjunctiva have a yellowish tint; the urine contains varying amounts of urobilin; the blood serum gives a positive, indirect van den Bergh test—bilirubinaemia is present; and the examination of the blood smear shows the presence of immature red cells. This combination of findings has come to be recognized as due to increased blood destruction. The best example of this type of anaemia is congenital or acquired haemolytic jaundice, a condition further characterized by increased fragility of the red blood cells. Following splenectomy in this condition there is a disappearance of the urobilinuria, the bilirubinaemia, the yellowish colour of the skin and conjunctiva, and of immature red cells from the circulating blood. From this result, one may conclude that increased blood destruction is a factor in the production of anaemia, and that in haemolytic jaundice the cause of the increased destruction is located in or related to the spleen, and can be controlled by removal of this organ.

A common type of anaemia characterized by increased blood destruction is Addison's anaemia—commonly called pernicious anaemia. During a relapse all the findings indicating increased blood destruction, as found in haemolytic jaundice, together with haemoglobinaemia, are present. These tend to disappear during a remission and to reappear in the next relapse. Although all cases show signs of increased destruction of varying degree in the beginning, deficient production, or aplasia of the bone marrow, may be the process active at the end in a certain number of cases. In these, relapses are usually not so sharply defined, and tend to occur at longer intervals. The reaction of the bone marrow to increased blood

destruction in Addison's anaemia is quite different to that in haemolytic jaundice. The chief difference is the presence in the circulating blood of numbers of red cells larger than normal and possessing a normal haemoglobin content. This is the earliest and most characteristic haematological finding in Addison's anaemia. It probably indicates an abnormal blood formation on the part of the bone marrow. Similar haematological changes are found in certain cases of anaemia associated with the presence of dibothrocephalus latus in the intestine, and have been reported as occurring very occasionally in anaemia associated with pregnancy, syphilis and malaria. As recovery from the anaemia follows the expulsion of the worm from the intestine, the emptying of the uterus in pregnancy, or the successful treatment of the existing syphilitic or malarial infection, it may be questioned whether one should consider these possible causes of the Addison type of anaemia. At any rate, the presence of dibothriocephalus latus in the intestine, pregnancy, syphilis and malaria must be considered as causes of an anaemia due to increased blood destruction, having signs and symptoms closely simulating Addison's anaemia. Occasionally in malignant disease, especially carcinoma of the stomach, an anaemia indistinguishable from Addison's may be present. In these rare cases it is more than likely that the patient is suffering from the two conditions. In the vast majority of cases of malignant disease the associated anaemia can be easily differentiated from Addison's anaemia by a careful blood examination.

Addison's anaemia is characterized by certain signs and symptoms which indicate that it is not a disease of the bone marrow alone. In fact, it might equally well be considered as a disease of the nervous or digestive systems. The aetiological agent, whatever it may prove to be, affects the nervous and digestive systems, producing characteristic changes in addition to those that are the direct result of the anaemia itself. Signs and symptoms indicating disease of the nervous or digestive systems are present in every case. They may dominate the clinical picture and be present for months, or even years, before signs and symptoms of anaemia develop. In many instances patients come complaining of numbness or tingling of the fingers, difficulty in doing fine work or picking up small objects, difficulty in walking, signs and symptoms due to disease of the posterior or lateral column of the cord —combined degeneration. Common gastrointestinal symptoms are periodic sore tongue, diarrhoea, constipation, or alternating constipation and diarrhoea, anorexia, nausea and vomiting. Seldom are all these signs and symptoms present in one case, but some combination of them always occurs. Evidence that the bone marrow is involved in these cases, whether signs of anaemia be present or not, is strongly suggested by the fact that the blood almost always, if not invariably, shows the characteristic macrocytosis diagnostic of Addison's anaemia.

In severe infections caused by streptococcus haemolyticus and staphylococcus aureus, a severe grade of anaemia may rapidly develop from increased blood destruction. A similar, but less severe, anaemia is present in acute rheumatic fever. The anaemia in chronic infections may be due to increased destruction in the beginning, but the anaemic condition is maintained from deficient blood formation. This very common type of anaemia is usually caused by malignant disease, exposure to chemical poisons, mainly phenol, benzol and anilin derivatives, and intoxications as in nephritis, in addition to chronic infections. Improper diet and bad hygienic surroundings, conditions which affect the general health of the individual, tend to depress blood formation, resulting in a mild grade of anaemia.

Apart from congenital or acquired haemolytic jaundice, idiopathic purpura, haemorrhagica and Banti's disease, where splenectomy produces such gratifying results for the cure of anaemia, no specific methods of treatment are available beyond an attempt to remove the aetiological cause. Accuracy in diagnosis is essential to any success in treatment. As anaemia is not the result of primary disease of the bone marrow in the majority of cases, but develops as a secondary manifestation in diseases primarily affecting other organs or systems of the body, the course of the anaemia is usually dependent upon our success in the treatment of the primary condition. In the group of cases where the chief manifestations of disease are the signs and symptoms of anaemia, an attempt must be made by thorough investigation to determine: firstly, whether it is the result of haemorrhage, increased destruction or deficient formation of blood; secondly, the character of the reaction of the bone marrow by a haematological examination; and, thirdly, a consideration of possible aetiological agents that may be responsible in the production, such as: haemorrhage, internal or external; infection; malignant disease; chemical poison; and intestinal parasites. With this information and care in investigation, fewer cases of apparently slight anaemia, but resulting from a more severe condition, as carcinoma of the stomach, subacute bacterial endocarditis, or duodenal ulcer, will be left undiagnosed as anaemias of unknown origin, and our respect as physicians for the sign pallor as a warning of disease demanding our best attention will be greatly increased.

THE THERAPEUTIC USE OF ENDOCRINE PREPARATIONS

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The active principles of the endocrine glands which we know as hormones have been described as therapeutic agents prepared by the body for its own use. Naturally there has been no need for the body to prepare very stable substances, as the glands supply the endocrines or hormones as the other parts of the body require them. This relative instability makes their isolation difficult. Further, there is no need that these hormones should be able to pass through the skin or mucous membranes of the body from without, or to resist the digestive ferments or the changes in acidity to which they are exposed when given per os. Consequently we find that all those of which we have any knowledge are much more potent, possibly hundreds of times, when applied subcutaneously than when given per os.

Of these endocrines six have been isolated in a more or less pure form. 1. Thyroxin from the thyroid gland, effective when given by the mouth. 2. Adrenalin, very ineffective when given per os; some small effect is produced by large doses. 3. Insulin from the pancreas. This too has very little effect per os, and only in very large doses. 4. Pituitary extract is also never given per os, as it has no effect when absorbed from stomach intestines, save possibly the oxytoxic effect on the uterus, and then its effect is weak, even if large doses be given. It is, however, absorbed from the mouth and nose. 5. Parathyrin. Collip states that parathyrin is readily destroyed by the digestive enzymes and is relatively very ineffective per os. 6. Ovarian follicular hormone. This hormone too appears ineffective if given per os.

Consequently, simply on the basis of probability, little effect is to be expected from any new hormone if given per os.

1. Thyroid. (a) The chief importance of thyroid or its hormone is in those cases in which there is an entire lack of the internal secretion, *e.g.,* severe thyroid aplasia, cretinism, or removal of the gland. Its prompt and beneficial effects are well known and do not require description.

(b) It is also of great value in cases where the secretion is relatively deficient, hypothyroidism. This too needs no further discussion, save to point out that careful studies of basal metabolism, *i.e.,* metabolism at rest, indicate that approximately 1 mgm. of thyroxin is produced normally by the body per diem, and that if less be produced the oxidations of the body are less than normal and can be increased to normal by giving thyroid. Further, the administration of excess leads to an abnormally increased oxidation and to other symptoms resembling those of Graves' disease.

(c) This increase in the oxidations within the body has led to thyroid being used as a means of decreasing obesity. It is, however, evident from the clinical and experimental work that has been carried out by numerous observers that loss of fat is always accompanied in these cases by an increased breaking down of protein, which is undesirable. Further, obese persons differ in their reactions to the exhibition of thyroid, and only those cases give satisfactory results in which the obesity is of the essential type, *i.e.*, due to some metabolic anomaly (possibly insufficient supply of the hormone), and not the cases whose obesity is due to over-eating. Consequently this treatment is not without the dangers of an over-stimulation of protein metabolism, as well as the production of a state of poisoning due to an excess of thyroid hormone. Consequently it is no longer used save by experts and under careful control.

(d) Eppinger in his book on oedema in 1917 called attention to the fact that the feeding of thyroid led to a definite change in the water metabolism of the body and of that of chloride. Under the influence of thyroid he found an increased secretion of water and sodium chloride both in animals and man, and in many cases of oedema a definite loss of water with improvement in the patient's condition. However, the precise indications for its employment for this purpose are not clear, nor are the physiological means by which thyroid produces this result.

As a medicament we have precise indications for the employment of thyroid in those conditions where the normal secretion is deficient. In these cases it may be used intelligently and with an assured expectation of the results to be achieved.

2. Insulin. In diabetes mellitus we have a deficiency in the internal secretion of the pancreas. The indications for its use have been abundantly discussed in recent literature. It does not seem that there are clear-cut indications for its use for any other purpose. The mechanism by which it produces its results in diabetes are unknown, and consequently attempts to produce other results are not based on any ascertained facts.

3. Parathyrin. In tetany in children we have doubtless to do with a deficiency disease, with the absence of an internal secretion. The absence of this secretion shows itself in an abnormality of the calcium metabolism. The calcium of the blood stream is reduced and the lack of available calcium as compared with the amounts of sodium and potassium produces the changes in the muscles and the nervous system which find their expression in convulsions and other symptoms. This lack of balance between these bases is promptly readjusted by the subcutaneous administration of the extract of parathyroid.

It is however, well known that tetany can be controlled by the exhibition of calcium salts by subcutaneous injection and that the damage to the parathyroids is rarely permanent in these cases. The

glands in time recover their function. Consequently it is possible that this extract may prove of more value in other types of cases where the metabolism of calcium seems to be at fault, since the administration of this extract to normals may increase the amount of calcium in the blood stream above normal and this may prove of value in some cases such as non-uniting fractures of bones, etc. This is, however, as yet nothing more than a hope.

It will be noted that each of these three endocrines are specific agents in the case of deficient function of their corresponding glands and that in these cases alone is there a definite knowledge which enables them to be given to produce a predetermined effect. All three of them produce definite pathological symptoms when given in excess to normal or abnormal persons. Excessive exhibition of thyroid produces a train of symptoms analogous to hypehthyroidism. Excess of insulin and the resultant fall in blood sugar causes the nervousness, restlessness and mental symptoms which culminate in unconsciousness or convulsions. Excess of parathyroid causes the clinical entity not yet observed in man, of hypercalcaemia. The symptoms in dogs are weakness, vomiting and diarrhoea, circulatory weakness and a thickening of the blood which is not due to an increase in haemoglobin.

4. Pituitary. The extract of the pituitary gland has come to have an assured place in the armamentarium of the obstetrician on account of the marked increase that it produces in the contractions of the uterus. These increased contractions are accompanied by a physiological increase of tone if too much be not given. It may be used to induce labor and in the thousands of cases in which it has been so employed it has proved to be free from danger to mother and child if sufficiently small doses be given at first. It is of even more importance in uterine inertia in the second stage of labor when the head is well down in the pelvis. In adequate and not excessive doses it increases the strength of uterine movements with only physiological increases in tone. The physiological basis for its use has only recently been disclosed and will be referred to hereafter.

All smooth muscle is stimulated by pituitary extract, but its exhibition appears to affect that of the bladder and of the gut more than that of the blood vessels. The cardiac contractions are increased, but except in atony of the bladder, in the post-partum period, or in the earliest stages of ileus, it finds little employment.

Another remarkable effect which appears to be of the nature of a substitution therapy, *i.e.,* the replacement of a normal hormone is shown when pituitary extract is given in diabetes insipidus. Here it causes the polyuria to cease and the thirst to disappear. Cushing's recent work tends to indicate that diabetes insipidus is due to a lack of the hormone contained in the extract.

5. Ovary. Only one hormone has been isolated so far from the ovary. Doisy and Allan and their co-workers have isolated from the fluid contained in the ovarian follicle a hormone which when injected into young virgin rats or splayed females produces those changes in the mucosa of the uterus and vagina which are characteristic of the oestral period. It might therefore be used to bring about menstruation in women, and might alleviate some of the symptoms of the menopause. So far as the author is aware it has not been used for this purpose.

The work of Dixon and Marshall, however, indicates the presence of two further hormones. They found that extracts made from the ovaries of sows which were free from corpora lutea, either true or false, produced an increased flow of the pituitary hormone. This freedom from corpora lutea is only found in the later days of pregnancy when the corpora lutea are degenerate and in the immediately succeeding days. All other periods, in many mammals, corpora lutea either true or false (*i.e.*, subsequent to an oestral period with rupture of a follicle but without implantation) are present. When corpora lutea are present some hormone from them seems to prevent the formation or the action of the hormone from the rest of the ovary. Some manufacturers supply extracts supposed to be made from corpora lutea alone, or from an ovary with corpora lutea. It is doubtful if they do so. If both are supplied there is no means of telling what result will be produced. If such preparations are given per os there is extremely little chance that they can have any effect. Till these hormones are extracted the employment of such preparations by the physician entails not only unknown risks since all hormones in excess appear to be deleterious, but also a display of unjustified credulity on his part.

Further, the work of these two authors suggests caution in the exhibition of pituitary extract to induce labor. If, owing to the degeneration of the corpus luteum, the other hormone is just gaining the upper hand and there is a nearly adequate but not a quite adequate supply of pituitary hormone in the blood stream, then little more is required to produce the desired increase in uterine movements and an excess may lead to an undesired increase in tonus.

Testicle. While doubtless hormones are produced by the testicle we have as yet so little knowledge of their effects and their source in the testicle itself that the employment of any extracts is quite unjustifiable.

Suprarenal. (*a*) Adrenalin. This was the first of the hormones to be isolated. Yet strange to say, we know very little about its normal physiological function. It is a powerful but evanescent stimulant of all sympathetic nerve endings, and causes, if given intravenously, a rise of blood pressure owing to the contraction of the arterioles, increase in cardiac rate and strength, relaxation of the stomach, the intestines, the bronchi, and urinary bladder, and a marked increase in blood sugar.

Certain of these properties are useful in medicine. The constriction of blood vessels leads to its use with local anaesthetics as owing to the vascular constriction they are more slowly carried away from the site of injection and also makes it of use as a local styptic. Its employment to decrease internal haemorrhage is unjustifiable and inefficacious. Given subcutaneously it does not affect the blood pressure, or has but slight effect, owing to its slow adsorption, but it does cause a relaxation of the bronchial muscles when they are in spasm and hence is of great value in asthma to provide temporary relief.

It has another property less well understood. It appears to decrease the permeability of the vessel wall so that the fluid of the plasma passes less readily. This may indeed be its chief physiological significance and is probably the reason for its remarkable effect in decreasing the swelling and itching in severe urticaria or in angioneurotic oedema.

Adrenalin is produced in the suprarenal medulla. Animals do not die if the medulla alone is removed nor do they show a characteristic train of symptoms though they are perhaps less active and less able to carry out muscular movements of an exhausting type. Removal of the cortex in those animals which have not supernumerary cortical bodies leads to death sooner or later. The cause of death has not been disclosed, but their symptoms do not parallel those of Addison's disease. This condition does not appear to be cured by the administration of adrenalin.

Many other sources of endocrines have been suggested. The evidence against the thymus having an internal secretion appears conclusive. That for the pineal gland almost equally so in the higher animals. For the spleen and bone marrow no evidence has as yet been presented that would suggest that they are endocrine organs.

Our correct position to-day is this. There are certain endocrine products which we know and understand and use in a physiological sense, namely, from the thyroid, pancreas, para-thyroid, and the pituitary, and for whose employment definite indications are established, namely, when there is reason to believe that their production by the body is insufficient. For the exhibition of adrenalin there are also definite indications even though there may be no reason to believe that its production is insufficient. .

There is no doubt that the manufacturer is playing on the credulity of the profession in offering many so-called endocrine preparations which are without value. Fortunately they are inert, for it they were active, there would be in many cases serious consequences as any true endocrine in excess is harmful.

CLINICAL ASPECTS OF POLIOMYELITIS*

A. P. Hart

Poliomyelitis is one of the diseases the diagnosis of which is very frequently missed in the early stages, so that if one can recall some of its clinical characteristics it may be beneficial.

Drayton has described poliomyelitis under three distinct groups.

First Group—Shows two distinct periods of illness with an interval of well being.

Second Group—This period of well being is not present, but there is a sustained course of indisposition of varying intensity.

Third Group—All the signs point from the start to meningeal and nervous tissue involvement.

In the first two groups there develops a picture of general systemic infection from which the child appears to recover completely or in part, and then to receive a second blow directly upon the cerebro-spinal tract. Some of the cases in groups one and two recover without ever developing signs of meningeal involvement. They have fever with symptoms falling into three main categories: gastro-intestinal, tonsillar and upper respiratory passage inflammation and general malaise without localization of symptoms. Following then a remission of all symptoms in the first group or a varying duration of symptoms in the second group, one of two things occurs—the patient promptly gets well or sudden evidence of meningeal involvement appears from which may follow recovery or paralysis. There are so frequently found in families where a frank paralytic case occurs, other children who present the same initial symptoms as the paralyzed child, but who recover without meningeal symptoms, that one is led to suppose that these are examples of infection in which no penetration of the meninges occurred. The third group may be looked upon as examples of the malady in which the systemic stage has been overlooked because of its triviality. The violent picture of the nervous symptoms dominates and drives the memory of slight indisposition from the mother's mind.

Every physician should think of the possibility of poliomyelitis when called to see a sick child during the summer months. It is essentially a disease of the July to December period, and mostly during July, August and September. In the records of the Hospital for Sick Children for nine years, only five cases were admitted which occurred outside of this period. One in April, one in May and three in June. ' Now what is going to suggest this disease to the doctor when summer complaints are prevalent in his practice? In its early hours the clinical course of poliomyelitis resembles in general that of all the acute infectious diseases of childhood. There is fever with its attendant symptoms. Then, depending upon which set of organs is chiefly involved, we may have

*Reprinted from University of Toronto Medical Journal.

(and this is usually the most common form) disturbance of the gastro-intestinal tract simulating a simple summer diarrhoea. Vomiting is likewise frequent. But tonsillar and pharyngeal inflammation or upper respiratory tract symptoms are not uncommon. Both of these may be followed by drowsiness. These symptoms may be present at the onset of any of the diseases with which the physician is meeting at this time of year. I believe that the points which will be of greatest assistance are:

First—To remember the possibility of the case being one of acute anterior poliomyelitis.

Second—The sudden onset. In a great many cases the parent can almost recall the hour of the day when the symptoms commenced.

Third—The spine sign. Test for pain and stiffness of the neck and back and resistance or pain on attempted flexion of these parts. There is a stiffening of the body which is protective, and may be carried to a position of moderate opisthotonos. This accounts for the fourth point, *i.e.*,

Fourth—A mingled look of apprehension and resentfulness which is quite unlike the alert, bright and shining eye of other fevers; and regarding the eye, the sclera and cornea present a glazed porcelain-like appearance.

Fifth—Pain and tenderness in the muscles. This has often led to the disease being mistaken for rheumatism.

Up to this stage, in a great number of cases, there is no definite sign of involvement of the central nervous system. Of course there are others which present perfectly definite signs of nervous involvement almost at the beginning. When does meningeal involvement occur? It may be indicated by sudden and definite increase in the spine sign, rapidly developing headache or disturbance of tendon reflexes. Spinal fluid examination, however, has shown that meningeal reaction may be actively under way when there is no sign or symptom to indicate it.

To await a confirmatory paralysis is not now permissible. The spinal fluid alone presents absolute evidence that meningeal invasion has occurred. In view of the importance of giving serum early, preferably while it is still in the general systemic phase, multiple lumbar punctures if necessary should be done.

Regarding the more general signs and symptoms and course, one should mention that in association with these symptoms there appears sometimes very early, sometimes later, headache, drowsiness and irritability. This irritability is frequently manifested upon approaching the bed. He fears movement of his painful limbs. The reflexes are present early, and may even be exaggerated if there is much meningeal irritation. Decrease in the reflex is a sign of oncoming paralysis, and of course absence occurs in the paralyzed muscle groups. Diarrhoea is a common symptom during the systemic phase, but one of the most

striking facts in the whole disease is the almost universal occurrence of constipation during the second phase. The temperature curve is frequently of short duration, and falls rapidly through 24 to 48 hours. Not infrequently, however, irregular or prolonged curves are met with.

During the very earliest stages the cerebro-spinal fluid is practically negative. There may be a slight increase in globulin. The pressure and volume are, however, practically always increased. Soon after the onset of paralysis, our usual findings at the Hospital for Sick Children have been that the fluid is clear, under considerable increase of pressure, with a slight increase in globulin and a cell count of 12 to 300. Draper quotes counts reaching to 2,500 cells per c.m.m., and states that fluids showing less than 100 cells in the first 12 to 18 hours following signs of meningeal invasion, are not likely to develop paralysis. The lymphocytes are usually high in preponderance, but very early there may be a preponderance of polymorphonuclears. Out of 111 cases which Dr. Park reviewed at the Hospital for Sick Children, one case revealed 315 cells, another 255 cells. 11 cases were between 100 and 200, and the remainder below 100. The globulin tended to increase as the cells decreased, and remained present for long periods when the fluid was otherwise normal.

The length of time between the first symptoms and the paralysis varies.

Dr. Park in reviewing the records of the Hospital for Sick Children found:

Less than 1 day	1 day	2 dys	3 dys	4 dys	5 dys	6 dys	7 dys	8 dys	not stated	no paralysis
5	2	10	6	4	7	2	2	1	4	4

When complete recovery occurs, it usually does so rapidly in from four to six weeks of the onset. During this second stage the affected muscles begin to waste and contractions begin to occur. Vasomotor phenomena, such as coldness and blueness of the extremities, also make their appearance. I should like to especially mention, however, the tendency to a marked neuritis which frequently occurs soon after the temperature has dropped to normal. This neuritis was particularly prevalent in the cases which have occurred in Toronto during the past summer. It has been most marked in the sciatic and femoral nerves of the affected limb, and marked tenderness is present along the course of these nerves. It is severe, and may keep the child awake crying with pain all night. Improvement in muscles may extend even over several years.

Regarding the prognosis—death in uncomplicated cases almost invariably results from failure of the muscles of respiration. If these are not affected the chance for life is good. As a rule the profoundly stuporous cases get well. Increasing apprehension and alertness with an existing paralysis is of grave significance. As mentioned, Drayton

thinks that cell counts under 100 during the first 12 to 18 hours are not likely to develop paralysis. Regarding the paralysis itself, it is remarkable the recovery that takes place in the badly paralyzed muscles, and partial cripplings frequently fully recover. Even after long periods unlooked for improvements may occur.

The results of treatment with human convalescent serum recorded by Draper, Amos and Taylor have been very encouraging. The important point is that it be given early. If given before paralysis occurs, it is believed that it will prevent the extension of the inflammation into the cord or brain and so prevent paralysis or possibly death. If it is not possible to diagnose the case at this stage, frequent lumbar punctures should be done and the serum given as soon as the spinal fluid shows the presence of globulin and an increase in cells. Patients with fever presenting the picture of headache, drowsiness and irritability, should be punctured. It usually has a sedative effect as well as giving early information of such importance. The usual custom is to give the serum into the spinal canal in not more than 15 c.c. doses after an equal or greater amount of the cerebro-spinal fluid has been withdrawn. Also it should be still more effectual if given intravenously. The most potent serum is that recovered from individuals who have recovered 3 to 4 months previously. Rosenow has reported brilliant results from the use of his anti-poliomyelitis streptococcus serum. If convalescent serum cannot be obtained, it would be wise to use this.

Regarding the subsequent treatment I shall only treat on general lines. Rest is essential. Paralyzed or weak muscles should be rested in the position of least stretching, and to protect them from the over-action of their unparalyzed opponents, splints will usually be necessary. Passive movements and massage should not be employed until all tenderness has disappeared, and then only by experts. The taking of weight on weakened leg muscles should be forbidden for several months. The parents should be warned at the outset that in order to get the maximum return of power it will require months of treatment, and that they will have a constant bombardment from friends and relatives to forsake the straight and narrow paths of orthodox treatment by regulars and stray into the alluring bypaths of the irregulars. It is our duty, however, to keep them out of such hands, and if we do so even in desperate cases it is wonderful the improvement which will often occur.

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UNIVERSITY OF TORONTO PRESS

THE BANTING RESEARCH FOUNDATION

A little over a year ago The Banting Research Foundation was organized, and during the past summer half a million dollars was collected, as an endowment fund, the interest from which will presently be available.

The objects of this fund are (*a*) to supplement the sum at present available in the University of Toronto for the carrying on of research in connection with the Banting and Best Chair of Medical Research, and (*b*) to make grants to research workers who have definite problems of medical research which owing to lack of funds they cannot adequately carry out.

As the Board of Trustees of the Foundation has power to make grants to such persons as present evidence of having definite problems which they cannot prosecute for lack of financial aid, whether they intend to work in Toronto or elsewhere, and since the Trustees are naturally anxious to be of as great assistance to medical research as the relatively limited income that they have at their disposal will allow, I am instructed to ask you to publish this letter in order that the existence and availability of this fund may become known to the readers of the University of Toronto Medical Bulletin.

Each applicant for a grant from The Banting Research Foundation will be called upon to set forth his problem and the method proposed for its solution, together with a statement of the amount and character of financial aid required for apparatus and supplies, for other items such as animals, as nearly as can be estimated, and for grants towards applicant's living expenses. Applications will be submitted to an advisory committee for report before a grant is made and should each be accompanied by a statement of what facilities are available in the place where applicant wishes to work, if not in Toronto, and a statement which would show that such expenses cannot be borne locally.

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All communications should be addressed to the Honorary Secretary, The Banting Research Foundation, Toronto 5.

Yours faithfully,

F. Lorne Hutchison,
Honorary Secretary.

SALT-FREE DIETS IN THE TREATMENT OF PRE-ECLAMPSIA

By Victor John Harding,
Professor of Pathological Chemistry, University of Toronto

There can be little doubt that diet plays a part in the production of eclampsia and pre-eclampsia. This is a statement common to many text-books, and finds expression in some of the theories of the etiology of this condition. Should one wish for direct and immediate evidence, it is to be found in the incidence of eclampsia in the countries of the central powers during the period of the world war. There was a marked decrease in eclampsia and pre-eclampsia during the years 1916-17-18 compared with the pre-war and post-war periods. This was observed in such centres as Munich, Berlin and Budapest: the reduction is attributed by the majority of observers to the dietary restriction of that period. Then too, the experience of pre-natal clinics on this continent is universally in support of the fact that proper hygiene during the pre-natal period results in a lessened incidence of this disturbance. Eclampsia and pre-eclampsia would thus clearly belong to the class of preventable diseases. The incidence of eclampsia varies from 1 in 150 to 1 in 500 births, the large difference being due to the method of collecting the statistics. The higher incidence is that of the hospital or lying-in centres: the lower incidence more nearly approaching its relation to the total number of births. Pre-eclampsia is much more common, and, although accurate figures are not available, Williams states it as occurring in some 5 per cent of pregnancies. This being so, the importance of working out accurately which particular part of the diet is responsible for, or contributes to, the production of eclampsia becomes evident. In general, protein and fat, either together or singly, is blamed, and in consequence many pre-natal clinics advise a restriction of meat and meat products during the latter half of the gestation period.

Scattered instances, however, are to be found throughout the medical literature where salt has been held to be a responsible dietary factor. Thus, Lafont, working in Algeria, notices that Europeans living there have a higher incidence of eclampsia than the natives, and attributes the condition to the more salty nature of the food of the former. De Wesselow and Wyatt, in their recent monograph "Toxaemias of Pregnancy", advocate a general light diet free from salt, on account of the nephrosis which is usually present in this condition, and with a view to the reduction of the attending edema.

Bearing these facts in mind, and feeling convinced that protein *per se* was harmless, the author, with the collaboration of Dr. H. B. Van Wyck, commenced a series of observations on the effect of diet on pre-eclamptics.

A series of preliminary experiments had first of all established the fact that diets high in protein or high in fat were without any harmful influence on a normal pregnancy. Kidney function tests on pre-eclamptics by other observers such as Spalding, Addis and Shevky, and de Wesselow, had made it clear that the kidney possessed its usual functional ability towards urea. Thus, as far as possible, the patients were safeguarded against any possible accident due to the change in diet. Protein or fat diets were given to patients showing definite signs of pre-eclampsia, such as oedema, albuminuria, retinitis, high blood pressure. Some patients received diets high in protein; others, diets high in fat; and others again, received both. The high protein diets contained meat or fish three times a day; the high fat diet contained large amounts of cream and butter, and invariably produced an acetonuria. The diets supplied slightly less energy than the patients required, but not so as to produce a marked loss in weight. The salt intake was rigidly controlled, being usually zero at the beginning of the dieting. When the oedema of the patient had subsided 3 gms. of salt were then added to make the diet more palatable. During treatment the patients were confined to bed. No purgation was attempted, the bowels being relieved by a simple enema each morning.

In all, we performed a series of twenty observations of this nature, all with the same results. The clinical condition of these patients did not grow worse, indeed they were greatly benefited by the dieting and the rest in bed. Had protein or fat been the dietary factor responsible for their symptoms, we should have expected the continuation of that factor would have led to a continuance or an aggravation of the symptoms. All the patients, however, improved, and a further series of cases, eight in number, were thereupon treated with ordinary hospital diet, but salt free. The results, as might be expected, were the same. The patients improved in clinical symptoms and general condition. We thus feel that protein or fat can be definitely ruled out as being the responsible dietary factor in the etiology of pre-eclampsia.

Whilst we have stated that the general condition of the patient improved, and the clinical symptoms abated, we do not wish to claim that all the symptoms were entirely relieved and that all the patients definitely passed from a condition of pre-eclampsia to that of normal pregnancy. Some cases showed complete recovery; in others, however, the albuminuria persisted, although perhaps diminished in amount, and the blood pressure fell to normal levels only on continued rest in bed. In order to illustrate our points we have selected four typical cases:

Case V-W represents a mild "toxaemia" in a primipara, showing an elevated blood pressure, some oedema of the ankles and albuminuria. On rest in bed on high protein followed by high fat diet with 3 gms. of salt daily, the oedema and albuminuria rapidly disappeared. There was a certain amount of epigastric distress after the heavy protein meals, but this was not present on the fat diet. We attempted to see the effect of a high salt intake on this patient but labor supervened.

Case W-T, also a primipara, represents a much more serious case. Her symptoms had commenced at about the fifth month of pregnancy,

increasing in severity. Headaches had been noted a month previous to admission to hospital, and some blurring of vision a fortnight previous. The feet had become badly swollen and the hands were beginning to show puffiness: the face was markedly puffy. Vomiting and intermittent epigastric pain had also been experienced. On applying to the hospital for relief she was admitted to the metabolism ward and placed on ordinary diet for three days, but afterwards on protein, fat, carbohydrate, and protein diets successively, covering a period of twenty-five days. The oedema subsided markedly, though we could never say it was entirely absent in the ankles. The average systolic blood pressure also fell slightly towards the end of the observations. The albuminuria became very much less, but never entirely disappeared. At one time doubts were entertained on the viability of the fetus, but a living baby was born. The puerperium was complicated by a throat infection and an attack of pyelitis which cleared under appropriate treatment. A mild albuminuria was still present on discharge five weeks later.

Case R-S represents a case that would be described as a "recurrent toxemia" and most probably as "of the nephritic type". There is a history of diphtheria in childhood, but no evidence of kidney disturbance until the first pregnancy. Following that, however, there had been a constant nycturia. The history of the various pregnancies is interesting:

Pregnancy I.—Eclampsia at 8 months; induction, stillborn baby. Pre-eclamptic signs for 2 or 3 months previous; treated by "no meat", purgation, etc., not kept in bed. Was 6 months in bed post-partum.

Pregnancy II.—Spontaneous labor 8 months. Pregnancy fairly normal throughout.

Pregnancy III.—Pre-eclamptic symptoms at 5 months, continuing to 7 months, then convulsions followed by spontaneous labor; stillborn baby; post-partum blindness; 2 months in bed.

Pregnancy IV.—Induction at 3 months because of "backache and pains in legs"?

The present pregnancy normal until about 2 weeks previous to entry to hospital. Had been under observation 3 months previous and had been on a meat-free diet. Two weeks previous to entry oedema appeared in extremities; some blurring of vision. Headaches 2 days previous; puffiness of face visible. The patient was put on an ordinary hospital diet for the first 3 days, containing a little salt. Even on this diet she improved, but the subsequent feeding of high protein diets or ordinary hospital diet without salt was followed by further improvement. Later, ordinary hospital diet containing salt led to a return of the oedema and general dull, heavy feeling. This, although not a well controlled observation, is in line with our conclusion from other cases, that salt is a much more dangerous factor in diet with reference to eclampsia or pre-eclampsia than either protein or fat.

Case C-C, II para and 7 months pregnant, was admitted for the definite pre-eclamptic signs of high blood pressure, marked oedema and headache. The symptoms of oedema and headache had first been noticed a month previous. There was also an indefinite account of blurring of

vision but examination failed to reveal a retinitis. The patient was put to bed, placed on an ordinary mixed diet of about 1,500 calories, but prepared salt free, and was maintained on this for a period of 44 days. Under this treatment she undoubtedly improved. The blood pressure, though varying markedly at times, as she was a nervous, excitable girl, fell to what would be considered a safe level. The oedema subsided markedly, though we must state that we were never satisfied that it disappeared entirely. The sodium chloride excretion in the urine showed that an equilibrium was reached at 2-3 gms. This probably represents an amount of chloride in the diet, which, though cooked and used without the addition of salt, nevertheless will contain small amounts of naturally contained chloride. The headaches disappeared and the patient became markedly improved in her general condition. Five weeks after admission the baby was still alive, but the death of the fetus must have occurred soon after this for no further movements nor heart sounds were noted; the blood pressure fell to a much lower level, and on induction of labor a small macerated fetus was delivered.

Having thus established to our satisfaction the innocuous nature of protein and fat we turned our attention to the influence of salt. The presence of oedema in the majority of pre-eclamptics would at once render inadvisable the use of salt in their diet. The experience we have just cited with case R-S shows that the retention of sodium chloride accompanying the oedema is responsible for some of the more generalized symptoms of which these patients complain.

Of interest, too, are our observations on case N-G, 4 months pregnant, who was brought into the metabolism ward of the Burnside Maternity Hospital as a normal case. During this early period of pregnancy she remained well on any diet. At 6 months symptoms of oedema appeared if the patient was left on ordinary hospital diet for any length of time. This was very marked at 7 months when, during the Christmas vacation, the patient was left for 14 days on ordinary salt-containing hospital diet. The oedema subsided on salt-free diet.

Our most striking example of the harmful effect of salt is that of the "toxemia" case of E-T., where the addition of 15 gms. of salt to a carbohydrate diet brought back the symptoms of oedema, headache, etc., which had disappeared on a diet of milk, orange juice and vegetables, followed by a diet preponderating in carbohydrate but containing only 3 gms. of salt.

There can be little doubt of the harmful nature of an excess of salt in the diet, though naturally we have hesitated to push our experiments to such a point where harm might ensue to the patient.

How can such results be interpreted? Are they the inevitable result of the existing kidney lesions, or are both merely symptomatic of a more generalized vascular disturbance? We incline towards the latter view. Our reasons for so doing are based upon the fact that an examination of the chloride content of blood during the progress of pregnancy shows that it increases constantly until about the seventh or eighth lunar month and then decreases to the end of the gestation period. Such results are

in harmony with those obtained by Plass and Bogert where they find, during the progress of pregnancy, a progressive hydremia until the sixth or seventh month of pregnancy, when it diminishes and reaches normal proportion some 2 weeks post-partum. Marked hydremia often characterizes the pre-eclamptic, and Plass supposes the toxaemias of later pregnancy to be merely an exaggeration or an extension of the normally occurring hydremia. If this is so, and if we believe that dietary control can reduce the incidence of eclampsia, it should be of a distinct value to have under control the intake of salt during pregnancy: such a control to be effective must be rigid. The amount of salt which is used in ordinary cooking is surprising. Thus, an examination of the urines of some 100 medical students who took their meals free from extra salt at my request has revealed the fact that from 7 to 19 gms. of salt may be excreted in the course of a day under these conditions. The average salt intake of the individual in Ontario is around 15 gms., an amount of salt which we should consider high were we to use it in an experimental diet. Salt equilibrium can be maintained on an intake of 3 gms. The normal pregnant woman can adjust herself to a high intake of 15 gms. salt and excrete a corresponding amount. A woman pregnant and liable to "toxaemia" does not so adjust herself: she continues to retain salt with the production of oedema. We would, therefore, suggest the setting aside of one week in every four during the latter half of pregnancy as a salt-free week, and that no salt other than that used in cooking be taken during the other three weeks. In this way any salt retained in the tissues is given an opportunity to escape. Such a regime should be a distinct beneficial addition to the usual pre-natal care.

CHOLECYSTOGRAPHY

By W. H. Dickson,

Department of Radiology, Toronto General Hospital

Since the Roentgen ray was first added to the armamentarium of the diagnostician probably no phase of the science has given rise to so much diversity of opinion, criticism and misunderstanding as the attempted diagnosis of gall-bladder disease and gall-stones by the radiological method.

Lack of appreciation of the difficulties contended with was no doubt to a great extent the cause of this unhappy condition. A gall-stone being to all intents and purposes a stone and of different density than the surrounding tissue should be shown on the plate or film. The criticism for failure to do so often being visited entirely on the radiologist, all other factors being overlooked.

If we only considered for a few moments some of the difficulties, much of this unjust attitude towards the radiologist would be changed. Gall-stones vary so much in their composition, some possessing no calcium whatever, others being of the same density as the surrounding tissue, it is readily seen to be a physical impossibility to demonstrate these by the ordinary method.

If an unbiased view of the literature on gall-bladder investigation by the radiological method is made we cannot help being impressed by the earnestness of all the investigators to place all the evidence possible on the plate or film. They also developed a high degree of efficiency in the interpretation of this evidence.

Knox of England, Ledoux-Lebard of France, McLeod of Shanghai, Cole, Pfahler, Case and Leonard and George of America, all brought their best efforts to bear on the solution of the problem. These men did succeed to a great degree in raising the percentage of correct diagnosis, and demonstrating the reason of failure when failure did occur. However, with the best that could be done it was found only 40 to 50% of gall-stones were actually being demonstrated.

The advent of the barium meal revolutionized the diagnosis of lesions in the Gastro Intestinal Tract, and the use of the opaque salts in the investigation of the Genito-urinary tract increased the efficiency of the workers in this field. With these lessons learned, it was felt that some similar method could be devised for the investigation of the gall-bladder. If some substance could be introduced into the gall-bladder by oral administration, subcutaneous injection or intravenously, the condition of the gall-bladder and its function could be studied. By such a method the diagnosis of gall-bladder disease would be placed on a par with Gastro Intestinal and Genito-Urinary work. Whatever substance was to be used must be non-toxic, easy of administration, unlimited in supply, and inexpensive.

To Drs. Ewart A. Graham and Warriner H. Cole of St. Louis, belongs the honour for the discovery of this method and the placing of it in the hands of every radiological laboratory.

In a search for a test of liver function various dyes were used. It was demonstrated certain ones were almost entirely excreted by the bile and gave shadows of the gall-bladder on the X-ray film. Among these was Tetra-Chlor-phenolphthalein. The Sodium salt of the Tetra-Chlor-phenolphthalein was first used, but the shadows given were not satisfactory. Further experiments were made with the Tetra Iod-phenolphthalein. Very satisfactory shadows were obtained of the gall-bladder in animals, but the toxicity was too great to allow its use in man. Tetra-Brom-phenolphthalein, the Calcium salt, was next used. When injected intravenously it was found to give clear-cut shadows of the gall-bladder and to have little toxic effect. It was the preliminary report of this work (1) that created a renewed interest in gall-bladder investigation.

In a few weeks time investigations showed that toxic reactions were occurring after the administration of the Calcium salt of Tetra Brom-phenolphthalein, the reaction being characterized by nausea, vomiting, headache, backache and a slight fall in blood pressure. On account of these reactions the Sodium salt of Tetra brom-phenolphthalein was tried intravenously. The latter salt being more soluble, a much less amount of solution was used, 35 to 40 c.c. being sufficient. In the report on the use of the Sodium Salt (2) it is stated that reactions were less severe and less frequent.

In a later article (3), Drs. Graham and Cole reported the use of the Sodium Tetra Iod-phenolphthalein Salt intravenously. Smaller doses of this salt are used as compared with the ones previously employed, 3.5 grams being sufficient for a patient weighing 130 pounds. The cystogram obtained being equally good in comparison with the ones obtained by the earlier method. The reaction was also found to be no greater than with the Sodium Tetra Brom-phenolphthalein. At this time the results obtained and reported from other laboratories appeared to be so satisfactory that we felt justified in adopting the method. Then cases were selected and the intravenous method used. The recommended technique was strictly adhered to and the Sodium Tetra Brom-phenolphthalein Salt used. Our experience at this observation was much different than reports from other centres led us to expect. 70% of the cases gave reactions varying from slight headache and backache to very severe vomiting and purging, and a marked drop in blood pressure. These results were probably due to some variation in the physical characteristics of the salt supplied us for the test. However, the results were so disappointing no further attempt at intravenous injection was done at that time.

The possibility of oral administration was brought forward and with this end in view suitable covering for the Tetra-Brom-phenolphthalein Sodium Salt was searched for. Simple gelatin capsules were first used, but on administration it was found the capsules were dissolved by the gastric secretion, liberating the salt into the stomach, thus causing nausea

and vomiting, very little of the salt passing into the intestine to be absorbed.

Hardening the capsule by exposure to Formalin for forty-eight hours was then tried. When these capsules were administered it was found most of them were carried into the large bowel and passed without dissolving, or dissolving late and setting up an intense diarrhoea.

The next step was to coat the untreated capsule with some substance not soluble in the stomach but soluble in the intestine. Eventually Keratin was used and proved satisfactory.

The shadows of the gall-bladder obtained by this method of administration of the Sodium Salt of Tetra Brom-phenolphthalein was not as clear as desired and the Sodium Salt of Tetra Iod-phenolphthalein was used. This latter salt gives a much denser shadow and is no more irritating when given orally than the Tetra-Brom-phenolphthalein. Through the aid of Mallinckrodts Canadian Branch at Montreal, compressed tablets of the salt were prepared and covered with a Keratin coating, .5 grams of the salt being used in each tablet. These tablets are the ones we use at the present time.

The patient to be examined receives printed instructions at the time the tablets are prescribed. These instructions are as follows:

At 7 p.m. supper is taken. The supper consists of a meal made up of carbohydrates, no fats or proteins being allowed, and the meal should be rather bulky. The Tetra Iod-phenolphthalein tablets are ingested during the meal. Eight .5 gram tablets are given for a patient weighing 130 pounds.

As soon after the meal as convenient the patient retires, reclining on the right side until sleep intervenes. During this time water is taken every half hour.

The patient is requested to be at the laboratory next morning at 9 a.m., no breakfast being indulged in, even the thought of food being abstained from, so no stimulation will be given to the gall-bladder.

A series of plates is made, and the patient is instructed to partake of a breakfast consisting of fats and five hours later a second series of plates is made.

With a normal functioning gall-bladder the first series should show a well-filled clear-cut shadow of the gall-bladder, the salt being excreted in the bile and concentrated in the gall-bladder. The second series of plates will show the gall-bladder empty, or nearly so. If a shadow is present the patient is instructed to return the following morning for further plates, when all traces of the salt have disappeared. If a shadow is present at the third series it is reasonable to presume that some obtrusive condition is present. If no shadow has been detected at any time during the observation it is evidence of malfunctioning, some one or more of the following being present. Gall-stones may be present in such numbers as to allow none of the salt in the gall-bladder. A stone may be present in the cystic duct, adhesions may be constricting the duct. The gall-bladder may have its mucosa so destroyed by chronic cholecystitis that concentration of the salt cannot take place.

In a series slightly in excess of 600 cases where the salt had been administered orally, about 70% of the cases gave a clear-cut shadow of the gall-bladder and emptied within twenty-four hours, showing normal function.

In the cases going to operation in which a diagnosis of malfunction had been given from this method 80% were correct. This 20% error in diagnosis was evidence that for some reason a certain number of normal cases did not excrete the salt in the bile, although the tablets were dissolved in the intestine, as evidenced by the presence of the salt in the bowel when plates were made.

To overcome the fact of non-visualization in these cases, the intravenous method was again adopted. By the intravenous method it was found 7% of the cases that failed to give a shadow when the salt was administered by mouth, gave very clear-cut shadows when the salt was exhibited intravenously.

Certain variations in the detail of the technique as described by Drs. Graham and Cole were made, more to fit the patient's working day than for any other reason.

The patient is requested to come to the laboratory at 4.30 p.m., breakfast and lunch having been taken. Cathartics are prohibited for the twenty-four hours previous. The intravenous injection is given at this time and a supper of carbohydrates is partaken of as soon as possible after the patient leaves the laboratory. Instructions are given to retire after supper and lie on the right side until sleep intervenes.

At 9 a.m. the patient presents himself at the laboratory, no breakfast being allowed before this, and the first series of plates made. A breakfast of fats is ordered and the second series of plates made five hours later. Twenty-four hours after the first series a third series is made. By this method if the gall-bladder is normal, a well defined shadow is cast on the film. The shadow will be somewhat denser and the gall-bladder appears slightly larger than by the oral method. At the five hour period a slight residue will be found more often by this method than by the oral method, but the third series made thirty-eight hours after the injection of the salt should show the gall-bladder clear.

The interpretation of the films made by this method is similar to the ones made after oral administration and stated above.

The technique used in the intravenous method is practically the same as employed in the administration of Salvarsan.

Two burettes are used, one containing the solution of Tetra Iod-phenolphthalein, the other normal Saline solution. These burettes are connected to a glass Y tube with clamps above the tube to close each burette as required. From the lower portion of the Y tube a single tube leads to the needle and in this latter tube is inserted a lamb's wool filter.

The Tetra Iod-phenolphthalein is dissolved in distilled water, 3.5 grams being used for an adult of 130 pounds. The solution is then made up to 50 c.c. by adding distilled water and the whole is sterlized in a water bath for fifteen minutes.

The needle is inserted in the usual way, a slight amount of blood being

allowed to flow. The Saline burette is then opened, about 10 c.c. being given to ensure the presence of the needle in the vein. This burette is closed and the one containing the Tetra Iod-phenolphthalein solution opened. 50 c.c. are allowed to flow into the vein, about twenty minutes being taken for this so that any untoward results may be noted early in the administration. When the desired amount of the salt has been administered the burette is closed and the normal Saline burette once again opened and allowed to run until all of the Tetra Iod-phenolphthalein has been removed from the tubing and needle, thus ensuring that none of the Tetra Iod-phenolphthalein passes into the cellular tissue.

In our series of intravenous cases we have had two cases of slight reaction, headache, backache and a grippy feeling lasting two hours. Two cases gave us very severe reactions, vomiting, nausea and headache, lasting for over twenty-four hours. Two cases developed Phlebitis and one case Cellulitis.

With our oral administration series practically no untoward results have occurred, a few cases reporting some nausea. On investigation it was found in all the cases reporting a gastric upset a very light supper had been taken. None of the cases taking a bulky meal at the time of administration of the tablets reported any disturbance.

Conclusions

1. By both the oral administration and the intravenous injection of Tetra Iod-phenolphthalein Sodium Salt the normal gall-bladder may be demonstrated on the X-ray films. The presence of stones may be demonstrated in many cases when the film made in the ordinary way would show no evidence. Definite deformities and evidence of adhesions involving the gall-bladder may be demonstrated.

2. In about 20% of cases for some unknown reason the oral method fails to give a shadow with a normal gall-bladder.

3. The intravenous method gives a slightly higher percentage of correct findings.

4. The oral method subjects the patient to no ill effects. The intravenous method gives reactions to a greater degree with the possibility of other untoward results.

We are of the opinion it is better to use the oral method as the routine procedure, reserving the intravenous administration for the case where there is any question of the gall-bladder being normal, although not visualized by the oral administration of the salt.

In closing we would like to acknowledge the help received from Dr. A. C. Singleton of the Department of Radiology. He adapted the Salvarsan apparatus to the particular needs of this work and kindly took charge of all the intravenous administrations.

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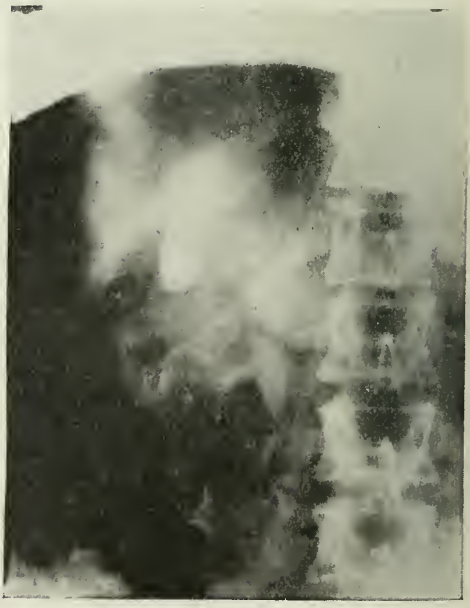
(1) J.A.M.A. Feb. 23, 1924, Vol. 82, No. 8—613.
(2) J.A.M.A. May 31, 1924, Vol. 82, No. 22—1777.
(3) J.A.M.A. April 18, 1925, Vol. 84, No. 16—1178.

Normal Gall-Bladder filled with Salt.

Same case five hours later, showing the gall-bladder nearly empty.

Gall-Bladder adhesions against lower border of liver.



Same case showing the slow emptying time.

Gall-Bladder filled with Salt and small soft stones.

Showing the Gall-Bladder filled with Stones and a slight amount of Salt.

Gall Stone.

Same case showing Salt in Gall-Bladder.

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UNIVERSITY OF TORONTO PRESS

COURSES FOR GRADUATES IN MEDICINE

95. The Faculty of Medicine of the University of Toronto recognizes that the practitioners of the Province are anxious to keep closely in touch with the advances in Medicine, and that they have a claim on the Provincial University to aid them in doing so. The Faculty considers this entails on it a duty second only to the instruction of the undergraduate.

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THE INTERPRETATION OF SYMPTOMS IN CHRONIC GASTRO-INTESTINAL DISEASE.

E. E. Cleaver.
Department of Medicine.

A consideration of symptoms in chronic gastro-intestinal disease demands a clear conception of gastric and intestinal physiology with a particular knowledge of the various activities of smooth muscle. It also demands a knowledge of the development of the abdominal organs and their nerve attachments, and lastly it requires an appreciation of the value of a careful history.

Disturbances of secretion are responsible for a few symptoms but the majority of visceral symptoms are related to the activities of smooth muscles. The mucosa of the alimentary tract is not sensitive to tactile, thermal or chemical stimuli, except in a limited portion from the teeth to the pylorus. The lower end of the oesophagus is sensitive to thermal stimuli,—for instance, cold drinks or ice cream produce the well-known brow pain, a reflex of the oesophageal branch of the vagus, referred by the fifth nerve to the brow.

Regurgitation of acid contents from the stomach into the oesophagus is said to be responsible for the production of so-called heartburn. Reichmann carried out a series of experiments with gelatine covered sponges, with attached strings. These capsules were swallowed and allowed to remain in the oesophagus for one hour and then withdrawn. The contents were expressed and gave the characteristic reaction for HC1 in cases of heartburn. Normal controls showed no free HC1. Recent experiments do not confirm the work of Reichmann.

In the stomach, Carlson, Hurst, and others have proved that chemical stimuli do not produce any sensation of the gastric mucosa, either under normal conditions or in the presence of a gastric ulcer. Carlson has definitely proven that the gastric mucosa is sensitive to thermal stimuli,—that is, to water at a temperature of 50°C. to 10°C. Hurst believes that the mucosa is not sensitive to thermal stimuli. Alcohol, mustard or pepper, introduced by a tube into the stomach, produces various degrees of pain, accompanied at first by a peculiar feeling of warmth.

Although the mucosa of the stomach is only sensitive to thermal stimuli, the stomach has, in health, a sensibility of its own. These sensations, according to Ryle, are four,—the first hunger, second appetite, third satisfaction, and fourth repletion. Carlson, after numerous experiments, concludes that the local element in the sensation of hunger is dependent upon the tonus and contractions of the gastric musculature. He also does not believe that hunger and appetite are different intensities in the same sensation curve. Ryle draws a very interesting comparison, —appetite is a pleasant and hunger an unpleasant sensation. Appetite

may occur when the stomach contains food. Hunger occurs when there is undue abstention from food. Appetite is a daily experience. Appetite may occur without hunger but hunger seldom without appetite.

In the state of satisfaction there is no sensation, the stomach walls are adequately relaxed and muscle fibres have assumed a normal posture. Repletion may give rise to sensations which are mildly uncomfortable or definitely painful and is experienced when the stomach is over-filled or too rapidly filled.

Cannon's theory of the acid control of the pylorus is at present being challenged. The radiologist has shown that the duodenal cap or bulb generally fills during the first few minutes after the taking of a barium meal. Again, in the case of achylia gastrica, we frequently find the stomach empty in half to one hour after ingestion of a meal. The acid may indirectly be responsible for the relaxation of the pylorus but that HC1 forms the major part in the control of the pylorus seems doubtful.

The observations of the physiologist and the radiologist have been most helpful in the study of the movement of food contents in the alimentary tract. When a solid bolus passes into the upper end of the oesophagus, the first law of the intestine comes into action. There is relaxation in front and contraction above and behind. The bolus requires from four to five seconds to pass from the upper to the lower end of the oesophagus. When the bolus reaches the lower end of the oesophagus, the cardiac sphincter relaxes and a reflex inhibition of the musculature of the stomach takes places to receive the oncoming bolus. In the case of fluids, we find the fluid arrives two or three seconds before the peristaltic waves reach the cardiac orifice. In the stomach, we find the peristaltic waves commence at the cardiac orifice on both the lesser and greater curvatures. The amplitude of the peristaltic waves at the cardia are very small, but they slowly increase in depth until their arrival at the pyloric antrum, and here we find the waves almost cutting the stomach in two. If there is any interference with the passage of the wave along either curvature, the waves may fail to arrive synchronously at the pylorus and the result is reflex peristalsis, with nausea and vomiting. Immediately following the arrival of the peristaltic waves at the pylorus, there is a relaxation of the pylorus, and the duodenal cap fills. There is some doubt as to whether every peristaltic wave reaching the pylorus is followed at once by filling of the duodenal cap. Under normal conditions, the barium meal passes readily through the duodenum, jejunum and terminal ileum. Four to five hours after taking the meal, the barium commences to enter the caecum. In the caecum, the contents of the bowel are subject to a churn-like action. Both peristaltic and anti-peristaltic waves occur. In the colon, the movement of the contents of the bowels is very slow, and there is a mass movement that takes place once or twice a day. Under normal conditions, the contents of the bowels reach the splenic flexure in about ten hours and the rectum in eighteen to twenty-four hours.

Alverez has pointed out that the mechanism producing peristalsis is to be found in the wall of the gut. The circular fibres contract after removal of Auerbach's plexus. He also points out that smooth muscle

is more sluggish than striated muscle,—slower to react and slower in recovering original length. Smooth muscle is able to maintain a firm and lasting contraction without fatigue. Smooth muscle reacts to tension. Smooth muscle shortens under influence of direct irritation.

It does not fall within the scope of this paper to discuss in detail the nerve connections of the viscera, but some mention must be made of the bulbo-sacral outflow (parasympathetic) and the thoracic lumbar outflow (sympathetic). The abdominal viscera are connected through the sympathetic system with certain definite metameres or segments of the spinal cord. We assume that both afferent and efferent impulses pass to and fro in connection with these spinal segments. The nerve connections of the stomach are related to the 6th, 7th and 8th dorsal segments; the duodenum to the 9th; the appendix to the 7th and 8th; the colon to the 11th and 12th; the liver 6th to the 10th; the gall bladder to the 10th and the pancreas to the 10th and 11th dorsal segments. The dorsal segments have their nerve connections with the skin, muscle and connective tissues of the abdominal parieties. Regarding the contractions of smooth muscle fibres of the gastro-intestinal tract, efferent fibres travel both in vagus and sympathetic; sympathetic mainly to the sphincters and the vagus through Auerbach's plexus to the musculature of the visceral wall.

Goldie points out the importance of a careful history. He states that 80 p.c. of the points of evidence upon which a diagnosis is based arise directly from the history, 15 p.c. from physical examination, and less than 5 p.c. from laboratory findings. In investigating a case presenting gastro-intestinal symptoms, attention should be directed towards determining: First the nature of the complaint; second the duration of the complaint; third the character of the symptoms (have they remained the same since onset?); fourth, have there been periods of freedom from symptoms? Fifth, have the symptoms been produced by unusual exercise, indiscretion, etc.? Sixth, have the symptoms been relieved by change of diet, manner of living, etc.? It is often very difficult to obtain a clear history from patients in the wards of a general hospital. Many of the patients are foreigners and understand very little English. We find that the history of the gastro-intestinal activities throughout the 24 hours is very helpful. We commence by asking the patient whether he has any symptoms before breakfast; whether he has any symptoms after breakfast; and we continue this investigation of his daily cycle throughout the day and night until the following morning.

I wish now to discuss certain outstanding symptoms seen in gastro-intestinal disease, 1st anorexia, 2nd nausea, 3rd vomiting, 4th heart-burn, 5th water brash, 6th flatulence, 7th pain.

In ANOREXIA, we have diminished tone or muscular rigidity of the stomach. In fatigue the smooth muscle of the stomach has loss of tone. Emotion, worry, etc., may cause impaired gastric tone, probably due to the influence of the sympathetic nervous system. In acute fevers and chronic systemic infections, muscular tone is impaired. In chronic alcoholism loss of appetite is due to general effect of poison on muscular

function and metabolism and excessive secretion of mucus, which prevents normal stimulation of gastric mucosa. In the alcoholic, appetite for breakfast is very poor.

We generally see anorexia in cases of marked visceroptosis, with an associated hypotonus of the stomach. In carcinoma of the stomach, when there is involvement of the body wall, there is loss of appetite. Absence of free HCL is generally associated with loss of appetite.

Loss of appetite may not actually exist. Patients frequently are afraid to eat because the taking of food causes distress or pain,—example, gastric ulcer, carcinoma of the stomach and in certain nervous and reflex conditions of the stomach. A poor appetite with a rapidly developing sense of fullness suggests structural disease of the stomach or a hypotonic stomach in a state of general poor health. In contrast, a good appetite with a rapidly developing sense of fullness suggests a small hypertonic stomach,—as in disease of the biliary tract.

NAUSEA.—Carlson points out that the sensation complex of nausea and vomiting may be initiated by stimulation of nerves in gastric mucosa, by many of the sensory elements in nausea involve a mechanism outside the stomach. The sensation of nausea is associated with a feeling of bodily weakness and a characteristic pain and distress, (sinking feeling). Frequently one may experience headache, dizziness, chills (from cutaneous vaso-constriction and sweating). Reverse peristalsis occurs in the stomach.

VOMITING.—In considering the causes of vomiting, there are: 1st, Those acting directly on the vomiting centre. 2nd, Those acting reflexly on the centre.

Central stimulants acting directly on the vomiting centre are toxic in nature, and include tobacco, toxins of uraemia, etc. Reflex causes: Stimuli acting reflexly on the vomiting centre include stimuli from the stomach itself and, by afferent fibres, from other parts of the body by the vagus.

A.—Gastric. Improper food, excessive ordinary food, irritant poisons, ulcer and malignant diseases of the stomach, and hepatic cirrhosis.

B.—General visceral causes, appendicitis and peritonitis generally, intestinal obstruction, Dietl's crisis, pelvic diseases, pulmonary tuberculosis, violent coughing, shock from a blow on the epigastrium.

C.—Through the central nervous system:—

1. Through the special senses, taste, smell or sight.
2. Brain, concussion, meningitis, haemorrhage, tumor, mal de mer, hysteria.
3. Spinal cord. Gastric crisis of tabes.

HEARTBURN.—The mechanism of this symptom we have already discussed. It is frequently met with in gall bladder disease, pregnancy, visceroptosis, so-called chronic appendix and rarely in duodenal ulcer. Heartburn not infrequently occurs as a persistent symptom for years, in cases in which no organic lesion can be demonstrated.

WATER BRASH.—Water brash may be defined as regurgitations of mouthfuls of clear, tasteless fluid, probably from accumulations of ordinary saliva and mucus in the oesophagus. Water brash occurs as a symptom occasionally in gastric ulcer. Two cases of carcinoma of the stomach that came under my observation had water brash as the only outstanding symptom for a period of several months.

After a hearty meal, reguritation of food occurs involuntarily and without strain or nausea, due to the relaxation of the cardia. It also occurs during periods of fatigue or in anxiety states. Regurgitation of food also occurs in cardiospasm, when we have a closed cardia.

FLATULENCE and DISCOMFORT.—These symptoms are met with in two different types of stomach. In the hypertonic, steer-horn type we find the greater curvature of the stomach three to four inches above the intercristal line. Discomfort commences shortly after taking a meal. This condition is illustrated in patients suffering with gall bladder disease. In contrast, the hypotonic, hook-shaped stomach is characterized also by a sense of fullness; greater curvature frequently three to four inches below the intercristal line; seen in visceroptosis and in cases of pyloric obstruction with associated dilatation. Epigastric fullness and discomfort lead naturally to the consideration of the symptom of gastric flatulence.

Flatulence is due to: (First)—swallowed air, probably accountable for 90 per cent. A certain amount of air is swallowed with saliva and food. (Second)—Regurgitation of gas from the duodenum. (Third)—Gas resulting from diffusion through the stomach wall. (Fourth)—Gas resulting from fermentation in cases of pyloric obstruction. Gastric flatulence may be defined as a feeling of pressure high up in the epigastrium, often underneath the sternum and sometimes widely diffused throughout the chest. Flatulence rarely ever produces actual pain, but is characterized by intense discomfort, often so marked that the patient wishes he could plunge something into the epigastrium to relieve the condition.

Flatulence coming on immediately after a meal, with a relaxed cardia and associated belching, is frequent in individuals who overeat. Flatulence occurring one-half to three-quarters of an hour after a meal is frequently a symptom in gall bladder disease. When the discomfort becomes acute, the individual, in an endeavor to relieve the symptom, swallows air and forces the cardia. Before the cardia can contract down, the gas, and, not infrequently, some of the contents of the stomach are forced through the cardiac orifice into the oesophagus, producing the belching, regurgitation, etc. This phenomenon is accentuated by the contraction of the strong abdominal muscles. Patients frequently repeat this process many times and apparently it affords them some relief, although there is very little change in the amount of gas in the stomach.

PAIN.—Visceral pain is by far the most important symptom in chronic gastro-intestinal disease. Hilton says: "Every pain has its distinct and pregnant signification if we but look for it." In investigating visceral pain, we have to consider several points:

1st—The character of the pain. Is it intermittent or continuous?

2nd—Type. Is it burning, boring, dull or acute?

3rd—Is pain general or localized?

4th—Radiation of pain.

5th—The timing of the pain. The relationship it bears to the functioning of the stomach, gall bladder, etc.

6th—Is the pain relieved by the taking of food, alkalis or vomiting?

7th—Is the pain increased by the taking of food?

8th—Is the pain continuous? Is the pain recurring day after day after the same meal or meals? Are there intervals of weeks or months of entire freedom from pain?

9th—Is the pain aggravated by exercise?

It is very important to see your patient when he has the pain. He is able then to define more clearly its character, radiation, etc.

Visceral pain may be classified as: (First), intermittent; (second), constant; (third), postural; (fourth), capsular.

First—Intermittent pain is due to excessive muscular contraction and the stretching of contracted muscle. Pain due to excessive muscular contraction is not constant, but the pain due to the stretching of a contracted muscle is more prolonged. Pain of this type is at its height during muscular activity. In gastric ulcer at or near the cardia there is little or no pain. At the cardiac end of the stomach there is no marked muscular contraction and the amplitude of the peristaltic waves is small.

Gastric ulcer involving only the mucous coats of the stomach does not produce pain. Introduction of dilute HCL by means of the stomach tube in a case of gastric ulcer does not produce any gastric sensation. When gastric ulcer has existed over a long period, it frequently loses its periodicity and becomes somewhat continuous in character. This generally indicates a chronic perforation with perigastric adhesions.

The pain of gastric ulcer is generally relieved by the taking of soda bicarb, or the emptying of the stomach. This is probably due to the lessening of muscular spasm and gastric tension.

The variability of pain in gastric ulcer may be due to the differences in properties of smooth muscle.

In duodenal ulcer we may have the intermittent type of pain. This pain occurs from one to four hours after meals. Pain may occur after every meal and during the night. Frequently it may only occur after the mid-day meal,—i.e. at from 3 to 5 p.m. The pain varies in character, just as in gastric ulcer, and may be burning, tearing, gnawing, etc. The location of the pain in the epigastrium is variable. Most frequently it is limited to the left of the medium line and above the umbilicus, although not infrequently it is localized on the right side. The pain in duodenal ulcer is practically always relieved by taking food. Water rarely relieves it. Soda bicarb. frequently does. Pressure often also affords temporary relief. If the pain is not relieved by the taking of food, pressure and an alkaline mixture, it is very unlikely that we are dealing with an uncomplicated duodenal ulcer.

Duodenal ulcer may give symptoms for weeks or months, with a daily history of pain, and then be followed by a remission of symptoms for months or years.

We meet with a certain number of cases that do not present the charcteristic symptoms of pain but have nausea, distress, discomfort or even heartburn, occurring with a definite periodicity. Again, we have a smaller group of patients who present a picture closely simulating ulcer. Pain occurs with a definite periodicity but persists only for a few days at variable intervals. Pain does not always occur after the same meal. This type of case also is relieved by the taking of food. Frequently, we find no evidence of an intrinsic lesion in the duodenum but find evidence of an extrinsic cause, such as appendix, caecum, gall bladder, etc.

Second.—Continuous or peritoneal pain is characterized by persistent pain, gradually increasing in intensity and associated with general constitutional picture of peritonitis. This naturally falls into the group of acute abdominal conditions.

Third.—Postural pain arises when tissue is stretched or pressed upon and is relieved by change of position or posture. It is seen in cases of lymphangitis and perilymphangitis, extending from ulcer or carcinoma.

Fourth.—Capsular. This occurs when we have a rapid enlargement of an inflamed solid organ, such as liver, spleen, etc. This type of pain is constant in character.

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PRESENT STATUS OF SERUM THERAPY IN THE TREATMENT OF THE EXANTHEMATA*

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The exanthemata or eruptive fevers constitute a group of clinical entities which have the following features in common:

(1) The appearance, during the course of an attack, of an exanthem or rash. Occasionally a case occurs in which this symptom is wanting or at any rate not observed.

(2) All are due to the invasion of living micro-organisms.

(3) Exanthemata are transmissible from one individual to another.

(4) A number of them are susceptible to specific serum treatment.

The exanthemata may be said to include the following: Cerebro-Spinal Meningitis, Dengue, Erysipelas, Glanders, German Measles, Scarlet Fever, Smallpox, Typhoid Fever, Typhus Fever, Vaccinia, Chickenpox. Antitoxins or anti-sera are or have been used in the treatment of:

Cerebro-Spinal Meningitis
Erysipelas
Measles
Scarlet Fever
Typhoid Fever

Specific serum therapy is of recent development. In 1890, von Behring prepared diphtheria antitoxin. This was the first specific serum. In 1894 Roux and Martin presented the evidence which indicated that the introduction of antitoxin treatment of diphtheria marked the opening of a new era in the history of therapeutics. Thirty-two years have since elapsed. In that time substantial progress has been made. Some of the limitations of serum treatment have been established. Fresh interest in the subject, however, has been aroused as a result of contributions made during the past two or three years.

A brief review of earlier work and a summary of the present position of specific treatment of Cerebro-Spinal (Meningococcus) Meningitis, Erysipelas, Measles, Scarlet Fever and Typhoid Fever will now be undertaken.

Cerebro-Spinal (Meningococcus) Meningitis:

Beginning in 1905, Jochmann and Kolle and Wassermann in Germany and Park in the United States prepared anti-meningococcic sera and reported the results obtained in the treatment of limited groups of cases. In the same year, Flexner and his associates initiated experimental

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work which was carried on for several years and finally resulted in a sound scientific basis being established for the clinical use of anti-meningococcic sera. In addition, Flexner and Jobling, Dopter, Netter, Gardner Robb and others reported the results obtained in the treatment of large groups of cases. Certain facts were quickly established. Among the more significant of these were:

1. In untreated cases of meningococcus meningitis in various epidemics the case fatality rate was 70 to 81 per cent. while among the treated cases it was about thirty per cent.

2. Potent anti-meningococcic sera contain opsonins which facilitate phagocytosis, bactericidal substances which destroy meningococci directly, probably anti-endotoxins and agglutinins.

3. The therapeutic efficacy of these sera may be determined with a reasonable degree of accuracy.

It was also learned that, while, as a rule, if serum treatment was undertaken early (preferably on the first day on which the symptoms were observed) gratifying results were obtained in the great majority of cases, occasionally it was recorded that patients failed to respond to serum treatment even when it was begun on the first day of the disease and where abundant and presumably potent serum was administered. In consequence, it was recommended that the horses used for the production of anti-meningococcic sera be given injections of a considerable number of different strains of the micro-organism. This was the usual procedure until 1918-19, when Gordon and others suggested that monovalent serum might be preferable. Such monovalent sera have been employed in the United Kingdom with a certain degree of success apparently. In the United States and Canada, polyvalent sera only have been used. Just recently (July 1926) Wadsworth and Kirkbride have published the results of a combined clinical and laboratory study. They conclude that "the immunization of horses with six selected representative strains (of meningococci) apparently produces serums of higher titre and polyvalency than with a larger or smaller number of strains."

With reference to the treatment of a patient presenting signs of meningeal irritation, it is essential that lumbar puncture should be performed as soon as possible; that, in the presence of a turbid fluid or demonstrable meningococci, serum should be injected into the spinal canal at once in amounts only slightly less than those of the fluid withdrawn. Early free drainage relieves pressure and is of itself beneficial. The patient can most often be treated successfully if lumbar puncture is done and serum administered under an anaesthetic. Serum treatment will, of course, be unavailing if the etiological agent is found to be any species of bacteria other than the meningoccus. Treatment will be of no avail frequently in cases of 'closed meningitis', where the foramen of Magendie is blocked and communication between the intra-ventricular and sub-arachnoidal spaces interrupted. In these circumstances the injection of serum into the ventricles after trephining or cistern puncture may be resorted to.

It occasionally happens that a patient suffering from meningococcus meningitis and progressing satisfactorily under specific serum treatment

quite suddenly presents alarming symptoms, fails to respond to further treatment and quickly dies. At autopsy or even before, such cases may show pneumococci as well as meningococci in the cerebro-spinal fluid. These cases of 'mixed infection' meningitis result fatally as a rule. It is a good practice, whenever it is at all possible, to examine macroscopically and microscopically some of each lot of cerebro-spinal fluid withdrawn during the progress of the illness. Cases of hemorrhagic meningococcic meningitis usually run a rapidly fatal course and do not respond to treatment. Such cases may give rise to difficulties in diagnosis. Experience gained during the Great War emphasized anew lessons learned earlier but sometimes forgotten, namely that the most important considerations are suitable preventive measures, then, when these fail, immediate lumbar puncture and early vigorous serum treatment (preferably with the patient under anaesthetic while lumbar puncture is done and serum administered) in every patient presenting the clinical picture of meningococcus meningitis.

Erysipelas:

Anti-streptococcic serum has for many years past been used in the treatment of erysipelas with apparently more or less indifferent results. Birkhaug believes he has recently established (1925-26) that a specific relationship exists between Streptococcus erysipelatis and erysipelas; that this micro-organism elaborates a specific antitoxin and that this latter neutralizes the exotoxin of Streptococcus erysipelatis. Furthermore, Birkhaug has been unable to neutralize erysipelas exotoxin with scarlet fever antitoxin. Susceptible persons will react to the intracutaneous injection of small amounts of erysipelatis toxin and convalescent erysipelas serum will neutralize this toxin. The results obtained in the treatment of sixty cases of erysipelas with erysipelas antistreptococcic serum have also been reported by Birkhaug who concluded: "Clinical trials in sixty moderately severe cases of erysipelas have demonstrated that intramuscular injection of erysipelas antistreptococcic serum, in amounts of 100 c.c of the unconcentrated and from 15 to 20 c.c. of the concentrated serum, when administered during the first three days of the disease, causes a prompt amelioration of toxic depression, a critical fall in temperature and pulse rate, prompt fading of the erysipelatous lesion and rapid absorption of the blebs and edema within the affected areas." Further reports on the results obtained in the use of this serum will be awaited with interest.

Measles:

Nicolle and Conseil in 1918 published the results obtained by them in a series of children who, after exposure to measles, were given a prophylactic dose of human convalescent measles serum. Very considerable interest has been manifested in this procedure and numerous communications reporting results have appeared. The work of Degkwitz has been especially interesting and his communications should be consulted. The literature up to 1924 was summarized by Zingher in an article published in that year. In that communication he detailed the methods employed in the Health Department of New York City

to obtain serum. Specific recommendations for the use of human convalescent measles serum, as well as the results obtained in a series of 160 exposed persons, were also set forth by Zingher. These results were summarized by him as follows:—

"Convalescent measles serum, plasma or whole blood has definite value in the prophylaxis of measles. It can be used to produce complete passive immunity, if injected within the first four or five days after exposure. It can be injected to modify the character of the disease rather than to prevent its development."

Doses of 2.5 c.c. to 7.5 c.c. of serum for children of three years of age were recommended. In the group of 102 non-immunes reported in this paper, 92, injected after exposure, were apparently protected, while nine developed measles.

Still more recently (August 1926), Park and Freeman and Haas and Blum report results obtained in prophylactic use of human convalescent measles serum in 1500 and 174 children respectively. Convalescent blood was withdrawn between the ninth and twenty-first day after the temperature had become normal. In certain instances, blood was withdrawn as late as five months after recovery. Park and Freeman recommend the injection of 6 c.c. of convalescent serum or plasma into children under three years of age and from 6 c.c. to 10 c.c. for children over three years of age, who have been exposed to measles five days (or less) previously. Park and Freeman emphasize that the administration of convalescent measles serum, if it does not prevent, will so modify the attack that it will be very mild and not likely lead to complications. Thus measles convalescent serum, in the light of these results, may be regarded as a valuable therapeutic agent which, when used promptly before the seventh day after exposure, will prevent the development of serious complications such as broncho-pneumonia, bronchitis, etc.

Townsend (1926) in reporting upon the results obtained in the use of measles convalescent serum states: "32 cases who received convalesent blood, at least eight days before the development of the rash, showed an average febrile period of 3.6 days, whereas 21 unprotected boys showed an average febrile period of 6.4 days." There were no complications in the group of 32, whereas, in the uninoculated group of 21, there was one case of broncho-pneumonia, one of otitis media, one of frontal sinusitis and one of external otitis. Townsend especially emphasizes the mild character of the disease among many of the boys who were inoculated.

The practical difficulty of obtaining adequate supplies of human convalescent measles serum prevents the widespread employment of this method of specific serum therapy. For this reason, the recent work of Tunnicliff and Ferry and Fisher has received considerable attention. In a word, these workers claim that a variety of Streptococcus viridans is the etiological agent of measles. Ferry and Fisher have designated it Streptococcus morbilli. Tunnicliff and Ferry and Fisher claim to have established the fact that this streptococcus elaborates an exotoxin which gives a positive skin reaction in those susceptible to measles, but not in those immune to the disease. Tunnicliff and Taylor believe

that intracellular toxin is more useful than extracellular n the measles skin test. These workers claim also that they have produced a specific antitoxin against Streptococcus morbille toxin. The widespread employment of measles antitoxin in a large series of cases with proper controls is essential before any conclusions can be drawn as to its value in specific therapy of the disease.

Just recently an article on "Measles Prophylaxis" by Hoyne and Gasul has appeared. They report the results obtained using immune goat serum. They summarize their results thus:

"There were forty-eight infants and children with definite exposures to measles. Serum was administered to thirty-nine. Thirty-four of these were protected from measles and five developed the disease in a mild form.

"There was no death or complication in any of the five cases and, in some instances, the rectal temperature did not exceed 100°F. The incubation periods were twenty, thirty-three, thirty-three, eight and sixteen days, respectively. The prolonged time in some of these suggests the possibility of second exposures.

"Among the nine contacts who did not receive serum, all but one contracted measles. In the unprotected eight having measles, there were two deaths.

"Of the total immunized, 12.8 per cent. developed measles in an attenuated form. In the unimmunized, 88.8 per cent. acquired measles, with a mortality of 25 per cent.

"Serum rashes occurred in only 13 per cent. of the cases and persisted for only one or two days.

"No untoward reaction of any kind was evident in the serum receptors.

"Tunnicliff's immune measles serum has been, in our experience, of definite value as a prophylactic for measles.

"If the serum is administered to contacts not later than the fifth day of exposure, always counting the date of onset as the first day of the disease, protection seems assured in about 90 per cent."

Scarlet Fever:

Moser in 1902 and Gabrichevsky and Savchenko in 1905 introduced scarlet fever serum into Austria and Russia respectively. Despite the appearance of several important articles in the Russian and German literature in 1905 and 1906, the opinion was very generally held that human scarlet fever convalescent serum was much superior as a therapeutic agent to such scarlet fever sera as were then available. Only the difficulties incidental to obtaining adequate supplies interfered with the widespread use of scarlet fever convalescent serum. Its value was definitely shown in the published results of Weisbecker, Reiss and Jungmann, Zingher, Kling, Widfelt, Weaver, Hannah and many others.

In 1917 Schultz and Charlton demonstrated the phenomenon of blanching. Convalescent scarlet fever serum, introduced intracutaneously into the skin of a patient with a fully developed rash, caused the latter to fade at the site of injection. That was evidence of specific antitoxin

neutralization of the toxin in the skin of the patient so treated. This observation was followed by an important series of papers on the bacteriology of scarlet fever and finally the work of the Dicks and of Dochez has established specific serum therapy in scarlet fever on a secure foundation.

What are the indications for the employment of scarlet fever streptococcus serum or scarlet fever antitoxin and what benefits will accrue to the patient when such treatment is carried out? Blake and Trask have published results obtained in the treatment of patients with Dochez serum. G. F. and G. H. Dick have also recorded results obtained where scarlet fever antitoxin, prepared by their methods, was used. Gardner Robb in Belfast, Cushing in Montreal and Hannah in Toronto have recently published their observations in large series of cases treated with specific scarlet fever serum or antitoxin. Cushing treated 500 cases with antitoxin during the year 1925-1926. Of these about 5 per cent. were classified as severe cases, the others as moderate or mild. During the previous year, Cushing had under his charge over 100 cases of practically the same types of cases not treated with serum. This constituted a control group. An additional control group of 300 was observed at the same time as specific serum treatment was given to the group of 500 patients.

The rule in treatment was to give a full dose of serum to every definite case of scarlet fever on admission, unless the case was extremely mild (temperature less than 100°F.) or when there was a history of asthma or idiosyncrasy to horse serum. Cushing states that the most constant and certain action of the serum is to produce a marked fall in temperature. A similar favorable effect on the pulse rate is observed. The eruption fades very quickly, a great improvement is manifested in the toxic symptoms, namely: rash, delirium, headache, joint-pains, etc. Cushing emphasizes that all observers are agreed that the administration of adequate doeses of potent scarlet fever antitoxin will cut short the first week's fever.

Cushing's observations on the effect of serum on the complications are also of interest. During 1926, in a series of 1073 cases, 45 per cent. developed complications, whereas, in those treated with the antitoxin, 25 per cent. only suffered from sequelae. Without serum, otitis media as a complication developed in 14 per cent. of patients, whereas, in the serum-treated group, only 8 per cent. developed middle ear disease. Similar favourable results were noted in respect of other complications. The case fatality-rate among scarlet fever patients under Cushing's care in 1924-25-26 has fallen from 3.5 to 1.2. per cent. Cushing believes that scarlet fever antitoxin should be administered to every case of the disease at the earliest possible moment. The dose of concentrated serum most generally recommended is from 15 c.c. to 30 c.c. repeated promptly if necessary.

Of the serum treatment of typhoid fever on y a word need be said. Chantemesse introduced a specific anti-typhoid serum which has had a very limited field of usefulness. Absolute control and elimination of typhoid fever through sanitary effort and specific prevention by means of typhoid vaccination have been found to be the correct solution of the

problem of typhoid fever. Since it is literally a vanishing disease, efforts towards prevention rather than treatment should concern us.

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The Faculty of Medicine of the University of Toronto recognizes that the practioners of the Province are anxious to keep closely in touch with the advances in Medicine, and that they have a claim on the Provincial University to aid them in doing so. The Faculty considers this entails on it a duty second only to the instruction of the undergraduate.

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HYPERTROPHIC PYLORIC STENOSIS

By W. E. Gallie.
Department of Surgery.

In looking back over the years of practice how distinctly most of us can remember babies that started to vomit two or three weeks after birth and that continued to vomit in spite of all forms of treatment until they finally succumbed to starvation! Such symptoms were attributed in some instances to a defect in the mother's milk; in others, to an error in the process of digestion. Recent discoveries have shown, however, that the trouble is due neither to the food nor to its digestion but that it is due to a mechanical obstruction at the outlet of the stomach. We now know that this obstruction can be relieved and that the majority of the patients can be cured. Great progress has been made during this century in reducing infant mortality and none is more striking than in the treatment of pyloric stenosis.

SYMPTOMS

VOMITING: This is the first and most constant symptom. At the onset it may resemble simple regurgitation but it soon becomes definitely projectile. The stomach contents may be shot out two or three feet like a stream from a wide-nozzled hose. The amount vomited varies greatly but in typical cases is always large. Frequently it is much greater than can be accounted for by a recent feeding, indicating that food which normally should have passed on into the duodenum has been retained in the stomach.

The period at which vomiting begins varies considerably. Some of the babies regurgitate after the first feeding and develop projectile vomiting within a few days of birth. Others do not vomit until the fifth or sixth week and occasionally not until the third month. The reason for this variation is uncertain. The usual explanation is that at birth the obstruction is not severe enough to cause vomiting but is sufficient to cause delay in the outflow of gastric contents. This delay causes inflammatory oedema of the mucosa and spasm of the pyloric muscle and ultimately so increases the obstruction that vomiting is induced. The time at which this occurs naturally varies considerably.

The character of the vomitus is important. It consists of food in varying stages of digestion mixed with gastric juice and more or less mucus. Only occasionally does it contain bile.

EMACIATION: Coincident with the onset of vomiting the baby ceases to make the usual gain in weight. In mild cases the weight may simply remain stationary or increase or diminish slightly, depending on how much food gets through the pylorus. In bad cases the child literally

shrivels up from starvation and dehydration. It is of the utmost importance that the weight of these babies should be recorded daily as more information as to progress can be gained from this than from any other method of investigation.

DIMINISHED EXCRETIONS: With the diminution of food passing through the pylorus reduction occurs in the size and frequency of the stools and in the amount of urine excreted. In severe cases this may become the outstanding feature and some have been reported in which the constipation was so complete that a diagnosis of intestinal obstruction was made, or in which the combination of vomiting and anuria led to a diagnosis of acute nephritis. As a rule, however, the reduction in the excretions is unlikely to confuse the diagnosis.

PAIN: Usually this is not an important symptom. It is seldom present in the early stages and may not appear till the second or third week of the disease. In most well developed cases, however, there is no doubt that with the extraordinary peristaltic contractions of the stomach following the taking of food, these babies have intermittent spasms of colic. This is shown by violent crying, by the flexing of the thighs on the abdomen during contractions of the stomach, and by the evidence of relief after vomiting.

PHYSICAL SIGNS.

The abdominal examination usually reveals signs which make the diagnosis unmistakable. It should be made carefully and without hurry and it should not be considered satisfactory until the abdomen has been inspected and palpated thoroughly at times when the baby is not crying. A good light and a warm room are therefore essential and a supply of warm saccharinated water in a feeding bottle should be on hand to keep the patient quiet.

VISIBLE PERISTALSIS: One of the most important signs of pyloric stenosis is visible gastric peristalsis. It may not be present at first but is easily induced by the giving of food or water. The waves start at the left border of the stomach and sweep slowly across the abdomen to disappear at the pylorus. One wave is usually starting as the previous one disappears. They are easily recognized as they produce definite undulations in the abdominal wall, and the crest of the wave is raised a quarter of an inch or more above the trough. Sometimes when they do not appear promptly the stomach can be stirred into activity by kneading it or by tapping on the abdominal wall over it, but as a rule the giving of water is sufficient. As the stomach fills the waves become more and more pronounced until finally the whole organ contracts at once and shoots its contents out of the baby's mouth and nose in the characteristic projectile manner.

While visible gastric peristalsis, culminating in projectile vomiting, is strong evidence of pyloric obstruction, it is not absolute evidence of

hypertrophic pyloric stenosis. Cases have been reported, and we also have seen several, in which this phenomenon has been observed and yet no stenosis was present. Occasionally a simple spasm of a normal pylorus will produce sufficient obstruction to cause vomiting and visible peristalsis. Further evidence should be sought, therefore, before a final diagnosis is made.

PALPABLE PYLORIC TUMOUR: The finding of a small hard movable tumour, about the size of an acorn, in the region of the pylorus is almost conclusive evidence of stenosis. To allow the palpation of such a tumour, the child's abdominal wall must be completely relaxed. It is useless to search for it while the baby is crying. The examination should be made, therefore, when pain is absent, and we have found that the best time is just after a spell of vomiting. Sweetened water from the feeding bottle is an excellent temporary sedative.

The tumour is situated a little to the right of the middle line, between the umbilicus and the liver, and it is best reached by dipping the fingers under the outer border of the right rectus muscle. Sometimes it can be felt immediately but more often a prolonged search is necessary before it can be discovered. Occasionally no tumour can be found during several examinations but on the next occasion it is felt with ease. This elusiveness is readily understood after one has operated on several of these patients as the mobility of the pylorus is such that the tumour may be close under the abdominal wall and as low as the umbilicus, or tucked up under the liver at the neck of the gall bladder where it is almost impossible to feel it. Persistent efforts to palpate it, however, will be successful in nearly every case of true pyloric stenosis.

GASTRIC RETENTION: Before deciding on the method of treatment the physician frequently desires accurate information as to the degree of obstruction present. A general idea of this can be obtained from the vomiting and the emaciation and in most cases the information so obtained is the best that can be had. Occasionally, however, it is desirable to have an accurate record from day to day of the proportion of food passing through the pylorus and this can be obtained by observing the time taken by a meal to pass into the duodenum or by measuring the amount of food retained in the stomach after sufficient time has elapsed for a normal stomach to empty itself. If a small quantity of barium is given with a feeding the progress of the food can be observed by means of the fluoroscope, and skiagrams made each half hour will give accurate information of the rate of emptying of the stomach. The method is troublesome and expensive, however, and we rarely use it. The measurement of the food retained in the stomach four hours after a feeding is comparatively simple and gives us all the information we require. After washing out the stomach with a weak solution of bicarbonate of soda a measured feeding is given and the baby put to rest for four hours. If vomiting occurs the stomach washing is repeated and another feeding given. At the end of four hours, by which time the stomach should be empty, a catheter is passed down the oesophagus and

the stomach contents aspirated with a Hess aspirating bulb and measured and the ratio of the food retained to the original feeding recorded. From such records made from day to day a fair idea can be formed of what is happening at the pylorus and a decision made as to the further treatment.

DIAGNOSIS.

The diagnosis is made from,

(a) the history of projectile vomiting, loss of weight and diminution in the frequency and size of the stools;
(b) the physical examination in which is revealed visible gastric peristalsis, intermittent distension of the upper half of the abdomen, and a palpable tumour in the region of the pylorus;
(c) confirmation of the history that the vomitus is not bile stained, and that the stool, aside from its small size, is normal.

In most patients every essential symptom and sign is present but occasionally all efforts to locate the tumour fail. If after repeated examinations, no tumour can be felt, and if the history and physical signs, with this exception, are typical of the disease, the action of the physician must be determined by the severity of the symptoms. If the case appears to be desperate the diagnosis of pyloric stenosis should be made at once and the appropriate treatment instituted. If, on the other hand, the symptoms are not so severe as to make a delay of a few days altogether unwise, a diagnosis of pyloric obstruction of unknown origin should be made and a further investigation undertaken to determine its nature. This will consist of (1) a calculation of the proportion of food passing the pylorus, by means of aspiration of the stomach four hours after feeding, or by observation of the passage of a barium meal, and (2) a therapeutic test to determine whether the obstruction is due chiefly to stenosis or chiefly or wholly to spasm. It should be remembered that occasionally patients are seen in whom the history and physical examination suggest the presence of a mild degree of stenosis but in whom no thickening of the wall of the pylorus exists. As in pyloric stenosis vomiting is the chief symptom and the presence of gentle visible peristaltic waves in the stomach adds to the difficulty of diagnosis. The condition is due to spasm of the pylorus, the cause of which is unknown. It has been observed that patients in whom it occurs frequently have a general condition of muscular hypertonicity. It resembles somewhat the pylorospasm of gastric dyspepsia in adults. If by aspirating the stomach after a meal it is found that 75% or more of the food is passing through the pylorus within four hours of the taking of food it may be assumed that stenosis, if present, is slight, and therefore not urgently in need of radical treatment. The therapeutic test also is sometimes very valuable. A drop of a fresh 1 in 1000 solution of atropin sulphate is given fifteen minutes before each feeding and the dose increased until dilatation of the pupils and flushing occur. If the obstruction is due to stenosis no improvement occurs in the symptoms or in the rapidity of emptying of the stomach; but if spasm is the chief cause of the obstruc-

tion, the vomiting may cease abruptly and the rate of emptying of the stomach into the duodenum return to normal. By the use of these tests, therefore, much assistance can be gained in making a diagnosis and in determining the best treatment to be employed.

DIFFERENTIAL DIAGNOSIS.

The conditions most apt to be mistaken for pyloric stenosis are regurgitation, pylorospasm, congenital atresia of the duodenum, intestinal obstruction and general peritonitis. In each of these vomiting is the symptom which leads to the confusion.

REGURGITATION is the simple bringing up of mouthfuls of food from an over-distended or too rapidly distended stomach. It rarely has the character of vomiting and is never projectile. It is usually cured by reducing the quantity given at each feeding and by making the baby nurse more slowly.

PYLOROSPASM has been discussed fully under the heading "Diagnosis". It may occasionally produce symptoms which are indistinguishable from those of pyloric stenosis but as a rule the vomiting is less projectile and the gastric peristalsis, if present at all, slight. The administration of atropin as described may produce a spectacular cessation of the symptoms and so clear up the diagnosis.

CONGENITAL ATRESIA OF THE DUODENUM produces symptoms within the first few days after birth which resemble those of pyloric stenosis closely. This is particularly true where the obstruction in the duodenum is above the entrance of the bile duct and so prevents the appearance of bile in the vomitus. The vomiting of all food taken and the total absence of stools are distinguishing features. If the atresia is below the ampulla of Vater the presence of bile in the vomitus excludes pyloric obstruction.

INTESTINAL OBSTRUCTION from any cause, at a point below the duodenum, will produce vomiting which may become projectile, but the presence of intestinal contents in the vomitus, and the absence of stools make the diagnosis clear.

GENERAL PERITONITIS may sometimes prove confusing owing to the projectile vomiting. The presence of intestinal contents in the vomitus, the signs of abdominal rigidity and distension and the attending febrile reaction distinguish it from stenosis.

PATHOLOGY.

Hypertrophic pyloric stenosis is a congenital abnormality of unknown cause. It has been suggested that it may be the result of muscular spasm before or after birth. The weight of evidence, however, indicates that it is a congenital anomaly in no way dependent on spasm and although

this may ultimately play a part in the production of symptoms it is the result of the hypertrophy rather than the cause.

In this disease the region of the pylorus is occupied by a firm, pale, fusiform tumour about the size of an acorn. The firmness varies from that of cartilage to that of soft rubber; the paleness varies with the firmness; and the size may be anywhere between that of a normal pylorus and that of a large pecan nut. The severity of the symptoms has no relation to the size of the tumour but the degree of obstruction appears to be in direct proportion to its hardness. The tumour is freely movable through a radius which is determined by the fixity of the first part of the duodenum, and it can usually be delivered through an appropriate abdominal incision. Proximally it fades into the muscular wall of the stomach but distally it ends abruptly and feels as if projected into the lumen of the duodenum much like the os uteri in the vagina. The blood-vessels can be seen in distinct relief against its pale wall as they pass from the mesenteric to the antimesenteric border. As they advance they diminish in size until an area is reached, an eighth of an inch wide and the full length of the tumour, which is white and practically bloodless. The stomach in the early stages is normal but in patients older than three or four weeks it is dilated and distinctly hypertrophied.

A longitudinal section through the tumour and the adjacent portions of the stomach and duodenum gives an excellent demonstration of the nature of the obstruction. It shows that the walls are greatly thickened and the pyloric canal much lengthened and narrowed. In a normal infant the muscular thickening which marks the pyloric opening of the stomach can barely be seen or felt, whereas in cases of stenosis the thickness from peritoneum to mucosa may reach a third of an inch. The hypertrophy occurs chiefly in the circular coat but it involves the longitudinal as well. In the normal infant, also, the pyloric canal is not more than a quarter of an inch in length but in stenosis cases it is always elongated and sometimes to as much as an inch. Towards the stomach the thickened muscle of the pylorus fades into the general musculature of that organ but towards the duodenum it ends abruptly and is not continued into the intestinal wall. The section shows clearly the projection of the distal end of the tumour into the duodenum and the similarity of its appearance to that of the os uteri and vagina. Viewed from the duodenum the most prominent part of the invaginated tumour is occupied by the pyloric orifice. The mucous membrane is seen to be reflected from the duodenal walls to the invaginated part of the tumour at the bottom of a deep sulcus which surrounds it and which corresponds to the vaginal fornices. In operation for the relief of the obstruction the presence of this sulcus should be remembered as it is very easy to wound the mucous membrane in this area with the point of a knife or scissors.

A transverse section through the middle of the tumour shows in addition to the great thickening of the muscle, a decided thickening and infolding of the mucous membrane. When it is compared with a similar section through a normal pylorus one gets the impression that if the

mucous membrane were distended to its limit the lumen would be much larger than in normal bowel.

Microscopic examination shows that the tumour is due to pure hypertrophy of muscle. The fibres are increased both in number and size. Nothing can be seen which would suggest that the tumour is the result of recent cellular proliferation.

TREATMENT.

The controversy which has been waged for the past ten years over the treatment of pyloric stenosis still goes on. Those who believe that the symptoms are largely the result of spasm advocate medical and dietetic measures; those who favour the congenital anomaly theory prefer surgical intervention. Both sides present statistics of recoveries to support their contentions. A review of the papers which are appearing, however, indicates that many of the leading paediatricians throughout the world, and some who were formerly strong advocates of medical treatment, now believe that their patients are better served by the operative relief of the obstruction.

Cures may undoubtedly result from both methods. Sometimes the milder cases will respond to the daily washing out of the stomach; a few show improvement after the administration of atropin; but the best results of medical treatment have come from the administration of what is known as "thick feeding" as advocated by Sauer. This feeding is prepared by boiling cooked cereal with milk, water and dextri-maltose for an hour or longer until the mixture is of a thick consistency and barely drops off the inverted spoon. One to two rounded tablespoonfuls of this thick cereal is given to the infant before each breast feeding. If the physician wishes to use thick feeding entirely it should be made up by boiling the cereal with the total amount of mother's milk. At least two tablespoonfuls of this mixture are fed to the infant five or six times a day. This method of treatment, either alone or combined with the administration of atropin and washing of the stomach, has proved of value at the Hospital for Sick Children in cases in which the vomiting has not been severe and in which the gastric retention was not great. Most of the patients in whom it has been used successfully have not had palpable tumours and have probably had very little organic obstruction. Occasionally, however, undoubted cases of stenosis have stopped vomiting as a result of it and after a prolonged period of stationary weight have gone on to recovery. But the comparative infrequency of such good results, the prolonged period over which careful treatment must be administered, and the danger which these delicate infants run from trivial infections have led the paediatricians to take the view that much better results can be expected from surgical treatment. The general plan adopted at the Children's Hospital, therefore, is to submit all undoubted cases of pyloric stenosis to operation. Only those cases are treated medically in which there is doubt that the obstruction is organic. These include the cases of pylorospasm and those cases of true stenosis in which a tumour cannot be felt. The former usually respond promptly

to the treatment but the latter do not. In these the decision as to further treatment depends on the severity of the symptoms. If they are mild, medical treatment is continued; but if they are severe, and particularly if the amount of food retained in the stomach four hours after a feeding is 40% or more, we think the safest plan is to do an exploratory operation in the hope of finding an organic stenosis which can be relieved.

Surprising as it may seem, these delicate babies stand an abdominal operation well. There is no doubt, however, that emaciation greatly increases the surgical risk, so that if an operation is to be performed it is well to get it over with while the patient is still in good condition. It is unfair to both patient and surgeon to persist in unsuccessful treatment until starvation has so lowered the vitality that any operation involving an anaesthetic is attended by grave risk. Even in advanced cases, however, if proper precautions are taken, a high percentage of recoveries may be expected.

Two measures are of the utmost value in preparing the patients for operation. They are the administration of glucose in normal salt solution and the transfusion of whole blood. In all except the very early cases dehydration and emaciation have progressed so far that the patient urgently needs both food and drink before any operation can be undertaken with safety. We have found that the subcutaneous injection of 100 ccs. of 10% glucose in normal salt solution, on the day before operation and again an hour or so before operation, materially reduces the risk. In severe cases the addition of a transfusion of 100 ccs. of whole blood is even better.

The best operation yet devised is that described by Rammstedt. It is much better than a gastroenterostomy in that it can be performed in a third of the time, that it relieves the obstruction without noticeable disturbance of the physiology of the stomach, and that it involves no opening through the mucosa. As performed at this hospital the steps are as follows:

1. The stomach is washed out with a weak solution of bicarbonate of soda.
2. The patient is anaesthetized with ether.
3. The abdomen is prepared by applying a 2½% solution of iodine which is then washed off with alcohol.
4. The abdomen is opened by a high two inch incision through the right rectus muscle. If it is kept well up to the costal cartilages the only organ exposed will be the liver. This is of importance as it does away with the inconvenience of having to deal with intestines presenting in the wound. Further, when the operation has been completed the liver will protect the abdominal incision from within, an important matter in crying infants.
5. The liver is pushed upward and the pyloric end of the stomach lifted out of the wound.
6. As soon as the pyloric tumour has been exposed the surgeon picks up the duodenum with the thumb and forefinger of the left hand.

He then squeezes through the duodenal walls against the distal end of the tumour and pushes it back towards the stomach. In this way the mucous membrane which lines the sulcus surrounding the invaginated portion of the tumour is flattened out and so protected from injury when the hypertrophied muscle is incised.

7. An axial incision about a sixteenth of an inch deep is made through the whole length of the peritoneum and the superficial layers of the muscle in the avascular area of the tumour.
8. The points of a small scissors are introduced into this incision at the thickest part of the tumour and gently separated. This movement tears through the muscle coat and exposes the mucous membrane; this bulges into the wound.
9. The whole length of the tumour is dealt with in this way until its distal end is reached. Here the surgeon must proceed with the utmost caution in order to avoid tearing or puncturing the mucous membrane. We think it wiser to leave a few of the muscle fibres untorn than to run the risk of opening into the lumen. Puncturing of the mucous membrane is shown by the appearance of bleeding deep in the wound, by the escape of bubbles of gas or by the exfoliation of a tiny rosette of pink mucous membrane. Should this accident occur the opening must be closed carefully. Triple 0 catgut on a very fine needle is all this delicate tissue will stand and it must be treated with the greatest gentleness or further laceration will result. When the hole in the mucous membrane has been closed the torn muscle should be sewn together again over it at the distal end of the incision in order to prevent a subsequent blow out. Failure to do this invites disaster in the form of peritonitis. Fortunately the closure of the muscle for this purpose does not lessen the effectiveness of the operation in relieving the obstruction, at least it has not done so in the three cases in which we have had to do it.
10. All digital pressure is now removed from the stomach and intestines and the tumour allowed to lie free for a few moments. If any small vessels are bleeding they are picked up with mosquito forceps and tied or are understitched with fine catgut. Slight oozing may be controlled by laying some muscle fibres, obtained from the rectus, in the wound or by dropping a small free graft of omentum into it.
11. The tumour is finally dropped back and the abdominal incision closed. In suturing the abdominal wound we have found it unwise to trust to catgut alone as the strain produced by crying is so great that the wound may be burst open. We always insert three or four silkworm gut sutures through skin, anterior rectus sheath and rectus muscle and leave them in place for two weeks. Fine catgut is used for the various layers as the knots of heavy catgut are difficult to cover up in these emaciated infants and are apt to ulcerate through the skin.

Before the baby leaves the operating-table 80 to 100 ccs. of whole blood is transfused into the saphenous vein in the foot or one of the veins in the anticubital fossa. We think this is of great importance and should not be omitted. Since it has become routine we have had no anxiety in regard to post-operative shock and we are certain that the patients become convalescent more quickly. It may be that the beneficial effect depends on the value of the blood as food and as a means of rectifying the dehydration.

The further treatment is a matter for the physician and preferably one who is familiar with the feeding of sick infants. At the Children's Hospital the post-operative treatment is in the hands of the paediatricians and it is largely due to their devotion to the care of these babies that our results have been so satisfactory. They have laid down certain principles based on ample experience which seem to us to be excellent. In the first place they believe that wherever possible the baby should be fed with its mother's milk, and if for any reason this is impossible, with milk obtained from a wet-nurse. They decry the practice of weaning these babies either before or after operation, at any rate until convalescence is thoroughly established. In the second place they believe that the sooner the baby is back to normal feedings the better and that the rapidity with which this can be brought about should be judged in each case by the manner in which the stomach and intestine respond to it.

Following the operation the patient is put to bed and allowed to lie quietly for two or three hours. Half an ounce of breast milk is then given and this is repeated every four hours with the addition of a drachm with each feeding. Larger quantities are almost sure to induce vomiting. Even when this plan is followed slight vomiting is frequent during the first few days after the operation but it is practically never projectile and need cause no anxiety. By the fourth or fifth day the baby may be put to the breast and from then forward treated as a normal child.

If this plan is carried out the results are brilliant. Nothing more spectacular can be seen in surgical treatment than the change which is wrought in these babies. The projectile vomiting ceases as if by magic and although some mild vomiting may persist for a few days, even this is gone in a week. The weight immediately begins to rise and it is not unusual to see the child increase at the rate of a pound a week until the normal weight is reached. By the end of a month or six weeks most of these patients are in all respects normal.

A warning must be sounded, however, that convalescence is not always as smooth as has been described. Many complications may be met with which only experience or forewarning can overcome. The chief of these is the tendency of emaciated infants to pick up infections which in ordinary children would be insignificant but which in them are exceedingly serious. The principal cause of mortality in our experience has been simple nasopharyngeal infection. This danger can be materially reduced by taking careful precautions from the time the patient is first seen. The baby should be in a warm room which is kept at a constant

temperature. It should never be exposed to draughts or undressed for physical examination except in a really hot atmosphere. Nobody should be allowed into the room who has a cold and where any doubt exists the attendants should be required to wear masks. In hospital practice provision should be made to prevent close contact of these babies with other children; physical examination and other interference by internes should be reduced to a minimum; and students should be kept separated from the patient by glass. In private practice we have found that the safest plan is to admit the patient to hospital just before the operation and return him to his own home as soon afterward as possible.

A second cause of mortality is the postponement of operation until such a state of emaciation and exhaustion is reached that the patients are nearly moribund. This is due in many instances to mistaken diagnosis and the number of babies admitted to hospital who have been weaned on the supposition that the mother's milk did not agree with them and who have been tried out on all sorts of substitute foods is discouraging. There has been a great improvement in this regard, however, in the last few years, coincident with the spread of knowledge of the disease, and the improvement will continue. In other instances the delay is due to ill-judged persistence in medical treatment in the face of continued vomiting and increasing emaciation. To those who favour a trial of medical treatment we would issue a warning that unless this treatment gives prompt and satisfactory results it had better be abandoned. The practice of carrying on medical treatment until the baby is nearly dead leaves little possibility for surgery to accomplish a cure.

A third cause of death after operation can be traced to inadequate pre-operative preparation of the patient. The clinical picture in some cases is so suggestive of a desperate emergency that recourse is had to surgery with needless and harmful precipitancy. What these patients need more than anything else is food and water and if this can be gotten into them in any way whatever they will make a remarkable clinical improvement and be much better prepared for the ordeal of an operation. Hypodermoclysis and blood transfusion are of great value in pre-operative treatment.

A serious post-operative complication in some cases is the onset of diarrhoea. It occurs almost always in patients in whom the obstruction at the pylorus has been severe and prolonged. It is thought to be due to the irritating effect of food on an intestinal tract which is not accustomed to dealing with it, but concerning it not much is known. We do know, however, that it is a symptom to be dreaded and one which can be prevented by early relief of the pyloric obstruction. It is treated by reducing the quantity of food to a minimum and increasing it in very gradual stages. The subcutaneous injection of glucose solution, and the transfusion of blood, must be resorted to to tide the patient over the period of starvation. In spite of these measures, however, some of these babies go on into a condition known as "decomposition" or "marasmus" in which the prospect of recovery is small.

To these causes of death following operation should be added those

of a purely surgical nature which must be expected occasionally after any operation. These are haemorrhage, wound infection, peritonitis and so on. In the hands of an experienced surgeon, however, these complications are rare, and no more to be feared in pyloric stenosis than in other conditions, such as inguinal hernia, in which operation is the recognized treatment.

The unanimity among the physicians and surgeons at the Hospital for Sick Children on the treatment of pyloric stenosis is based on the results. Approximately 150 patients have been operated upon over a period of thirteen years and of these the great majority have been well ever since. In none that recovered has there developed any late symptom which could be attributed to either the disease or its treatment. We believe that in ordinary hospital practice we can anticipate the cure of at least 90% of the patients and in private practice as many as 95%.

In the preparation of this paper I have tried to present the views of both the medical and surgical staffs of the hospital. That there is unanimity is perhaps the strongest argument that the views expressed are, on the whole, correct. For the medical aspects of the subject I am wholly indebted to the physicians, and for this and for their untiring efforts in the pre-operative and post-operative treatment of the patients, they have my best thanks.

MODERN ADVANCES IN OPHTHALMOLOGY

By Alexander E. MacDonald
Department of Ophthalmology

Helmholtz (1821-1894) with his epoch making work in physiological optics placed ophthalmology on a scientific basis. The efforts of international workers, striving in friendly rivalry, at times in the spirit of bitter controversy but mostly in harmony, have developed the position of modern ophthalmology as the most exact science in the practice of medicine.

IN REFRACTION AND MUSCLE BALANCE:

The increasing complexities of life force us to keep abreast of the times. Better lighting and printing, medical inspection in schools, the increased use of glasses, have added greatly to the comfort of near workers. Glasses do not always mean comfort.

In practice, the ophthalmometer has long since been discarded for the retinoscope. With a small plane mirror, a small intense source of illumination and the use of a mydriatic the eye may be measured for glasses with mathematical precision. This is not sufficient even when signs of early or definite disease are absent. At least twenty muscles must work together in the complicated movements of stereoscopic binocular single vision. The relation between accommodation and convergence is important in considering the comfort that will result in near work. Hypermetropes have to accommodate more than the normal amount for near work and moderate errors produce esophoria or a tendency for the eye to converge excessively. Higher degrees produce, in children with poor fusion sense, esotropia or convergent strabismus.

Myopes due to the fact that less accommodation is necessary to see clearly at reading distance, suffer from deficient convergence, i.e., the tendency is for their eye to diverge. This exophoria results, if poor fusion sense is present, in exotropia or divergent strabismus, in the higher degrees of myopia.

Hyperphoria or the tendency of the eyes to deviate vertically, produces very distressing symptoms such as severe headache, even going on, with the effort to perform near work, to nausea. These patients are irritable and the continued necessity for near work may result in a nervous breakdown.

Today, every eye examination is completed with a thorough near and distant muscle test. If esophoria is present fuller corrections are given than with normal balance. If exophoria is present, the astigmatism is corrected and the lowest sphere required for clear vision is prescribed. These cases do well with convergent exercises which, if persisted in, will develop the internal recti so that near work may be done in comfort.

Convergent exercise should be carried out in this manner. The patient being seated with his back to a good light, fixes the end of a pin or a pencil held directly in front at arm's length and on a level with the eyes. The object is now brought slowly towards a point about 8 cms. in front of the bridge of the nose until the object becomes blurred. The point should now be pushed away until it is seen clearly again. The effort to locate the point must not relax and the object is again brought closer until it blurs. The eyes are now closed and after a rest the exercise is repeated. A few minutes exercise every morning varying with the condition of the patient is sufficient and it should be carried on for many weeks. No other person should be present to distract the concentration required for the above treatment. After the age of forty-five, near reading may be substituted for the above exercise, *i.e.*, the patient reads each morning, a few paragraphs of medium sized print as close as he can with comfort while wearing his near glasses, which should be an under correction.

Every young near worker should have his refraction estimated with a mydriatic (provided there are no indications against the use of the drugs used to relax accommodation) and his muscle balance recorded. I consider it a serious circumstance for a presbyope, whose profession requires much near work, to be found for the first time to have any considerable degree of exophoria. This becomes more important with the increased expectancy of life, increased standards of living and the necessity for fuller information in so many walks of life.

Today an alarming number of glasses are ordered by poorly trained persons who as "opticians" or "optometrists" pose as self-styled "doctors". These people do moderately well with the presbyopes as it is a physiological fact that, granted normal vision, one will require approximately a +1.00 sphere for near work at 45, a +1.50 at 50 and a + 2.50 at 60 for near work. This is so simple that even a layman may pick up a pair of glasses at an emporium and "*manage*" to read with them. It is granted that this business of supplying glasses has in the past fulfilled an educational purpose and the danger lies in the servant attempting to imitate the master, *i.e.*, to diagnose and treat, for this is in fact what should be done in ordering a pair of glasses. The relation between the medical "prescriber" and the "dispenser" of drugs parallels the relation that should exist between the oculist and the optician.

IN ANATOMY AND PATHOLOGY:

The Nasal Sinuses:

While still lacking pathological evidence to confirm fully the clinical findings, it is now realized that retro-bulbar neuritis, iridocyclitis, ocular asthenopia and headaches due to the use of the eyes are at times associated with nasal sinusitis.

Focal Infection and Dental Disease:

Tonsillar disease, prostatic gonorrhoeal infection, etc., besides being associated with headaches increasing with the use of the eyes, may pro-

duce iritis, vitreous opacities, retro-bulbar neuritis and central retinal degeneration.

Lacrymal Apparatus:

It now seems probable that instead of the tears being syphoned away from the conjunctival sac or drainage resulting from the action of gravity, it is due to a negative pressure created in the sac. Some fibres of the orbicularis are attached to the anterior surface of the sac and the contraction of these fibres tends to open the sac, as the eye is closed in the act of winking. The valves in the naso-lacrymal duct close or the duct walls collapse during the muscular effort, possibly too the nasal passages with their alternating currents of air bear some relation to tear drainage.

Epiphora, while an apparently insignificant symptom to one who has never been inconvenienced thereby, is a complaint that will bring a patient back to a clinic with a persistence that leaves no doubt in an oculist's mind as to the sufferer's opinion on the matter. Elderly people are the chief sufferers and a simple procedure will guard against this distressing affliction and also against the tendency to ectropion and eversion of the puncta, in those who have flabby lower lids. Advise your patients always to wipe their eyes towards the root of the nose. Gentle massage up and in along the lower lid will cure this condition if adopted early.

Cerebral Ophthalmic Tracts:

Much has been done during the Great War to trace out these connections, with the localizing value of signs of injury in their distribution that would take us too far afield to discuss in this paper. The localizing information to be derived from the fields of vision, central and peripheral, is a necessity in every case of optic atrophy. It may be stated that no careful oculist will diagnose optic atrophy from a fundus examination alone. Pallor of the disc is a sign that must take us at once to the perimeter if errors are to be avoided.

Central Colour Vision:

Inability to recognize reds and greens two m.m. in diameter with central vision forms one of the earliest signs of retro-bulbus neuritis. The papillo-macular bundle is, being highly specialized, particularly susceptible to injury by toxins and in this bundle are the elements that carry the impulses, which psychologically are recognized as colour.

Instruments of Precision:

The rotatory prism, maddox rod, crossed cylinders, binocular loupe, some form of stereoscopic campimeter, Bjerrum's tangent screen and Stilling's or Isharahas' colour charts for the recognition of colour blindness have been established as necessities in the ophthalmic clinic.

Biomicroscopy:

The Gullstrand Slit-Lamp which is simply a binocular microscope mounted to observe a narrow beam of light from a nitra lamp as it is

focussed in the so-called transparent media of the eye. This instrument which was used on the continent during the War has now come into general use as an aid to early diagnosis of iridocyclitis, neuropathic keratitis, lens opacities, sympathetic uveitis, and injuries of the globe including the evaluation of the trauma resulting from foreign bodies. It has added greatly to our knowledge of the anatomy and physiology of the eye and it will continue to do so. The capillaries and endothelial cells of the cornea may readily be seen by its aid and changes in them studied in life.

Red-Free Light:

The fundus with whole light (as with the ordinary ophthalmoscope) shows a red reflex due to the blood pigment contained in the vessels of the choroid. Outside of the retinal vessels and retinal pigment changes associated with choroidal disease, it is difficult to investigate the transparent retina. Red-free light shows the radial distribution of nerve fibres as they pass to the optic nerve. This arrangement is interrupted for the temporal horizontal area by a curved arrangement to accommodate the increased number of nerve fibres arising from about the fovea.

New connective tissue associated with the vessels of the retina following papilloedema, is also well demonstrated, so too retinal haemorrhages, exudates and localized damage to the nerve fibres. The so-called red-free light apparatus with an incandescent lamp of low voltage is of little value as compared with red-free light produced by the carbon-arc with appropriate light and heat filters.

SURGICAL:

The Elliott Trephine Operation for Glaucoma:

Elliott published in *The Ophthalmoscope*, July 1910, p. 482, the details of his operation for chronic glaucoma. It does not replace the usual iridectomy in acute cases of glaucoma. But in chosen cases—those which have a chronic glaucoma with moderate tension that may be reduced with active treatment to nearly normal and in which the field of vision is not cut beyond 20-25° of central fixation—it is a most excellent surgical procedure. Patients with chronic glaucoma will not continue indefinitely the use of a miotic; it will lose its potency in a given case, the supply may be exhausted or unavailable due to change of residence, etc. Therefore operation is more urgently indicated, when chronic glaucoma is diagnosed in a fairly white and quiet eye, than in a case of chronic appendicitis. It is even advocated by some as an indication for operation for a quiet eye with very little nasal restriction in the field, *i.e.*, practically as soon as glaucoma is definitely diagnosed.

Implantations Following Enucleation:

The desirability of obtaining a good cosmetic result following an enucleation is so important that much effort has been given to the selection of a suitable procedure. The Mules' operation is to be avoided as sympathetic ophthalmia has arisen following the procedure. The

desirable implantation methods include cartilage, (Magitot—Bull. et Mem. Soc. de Chir. de Paris, 1921, V. 47, p. 1358), fat, which frequently forms but a poor support for a prosthesis due to its late absorption, gold globes and glass globes. The latter is probably the best method. It is satisfactory if a large globe is used so that it will not slip outside the tendons and form an obstacle to the fitting of an artificial eye. Special suturing methods such as the double suture are practicable. The ends of the tendons with their flared attachments are united with a mattress suture that is tied outside the conjunctiva in the lower part. The freely dissected conjunctiva is then caught up with a continuous suture so that a double flap is formed over the globe.

Marsupialization of the Orbit:

Enucleations that have not employed the implantation of an artificial globe may be re-operated. The tendons are separated and the glass globe inserted in the cavity thus formed. It requires careful dissection and may be employed provided too long a time has not elapsed following the enucleation. Inflammation following the enucleation operation would, of course, form a contra-indication.

Restoration of Socket:

Infrequent changes of the artificial eye cause the socket formerly large enough to accommodate an artificial eye to become so constricted that it is impossible to retain one. The Wheeler operation may be employed to remedy this defect. The procedure includes a wide dissection of the lids to the margin of the orbit, removal of all scar and conjunctival tissue and the insertion of a dental wax plate moulded to the shape of the socket, on which a large Wolfe's graft has been wrapped. The use of considerable pressure is necessary for the successful "taking" of the graft.

Local Anaesthesia:

Intra-ocular operations on the globe following prolonged inflammation of the conjunctiva are painful, as it is difficult to use sufficient cocaine for anaesthesia without damaging the cornea. In the past a general anaesthetic has been employed in these cases. The patients are usually old and concurrent chest or heart conditions may form a contra-indication to general anaesthesia. These cases may now be handled painlessly by using block anaesthesia. Novocain with adrenalin is injected by means of a 30 m.m. needle to the ciliary ganglion. In cases where it is desired to produce complete blocking of painful stimuli a second deep orbital injection may be made to block off the long ciliary nerves as they leave the nasal branch of the fifth nerve.

The Van Lint method of controlling the orbicularis oculi muscle is indicated in neurotic patients upon whom cataract extractions are to be performed. Complete relaxation of this muscle may be secured by injecting novocain and adrenalin into the orbicularis muscle. The needle is inserted opposite the orbital tubercle and then passed upwards leaving a track of local anaesthetic in the muscle tissue. The point is then passed downwards to block off the lower part of the orbicularis.

Hygiene and Prevention of Blindness:

All myopes and their parents in cases of myopic children of the school age, should be warned against the use of the eyes for work requiring prolonged strenuous visual effort as in the reading of fine print, or performing fine needlework. These patients should never read in poor light. The light should come from the left side in right handed people (so that the pen or pencil shadow does not fall on the work). Twenty-five cycle current should be rendered less trying by the use of porcelain or frosted globes to scatter the light and reduce the flicker. The eyes should never be used by the patient while in the lying position, either prone or dorsal. The patient should sit upright. The desk should be sloped and only clear large type on an unglazed paper used. Reading in any moving vehicle, train or street-car should be prohibited.

The eyes should be examined every one and one-half or two years until maturity is reached and the use of the eyes suspended completely by the use of atropine if there is a tendency to rapid increase in the myopia.

Distribution of Light:

Good bright light should be widely distributed in the room in which fine work is being done. It is undesirable that the illumination should be directed on the work itself as the heavy shadows in the rest of the room cause the eyes to adapt themselves to the varying degrees of illumination and discomfort results.

Sight Saving Classes:

In Toronto, sight saving classes are conducted for children having less than 6/18 vision in the better eye. These classes also admit children with progressive myopia. Specially trained teachers are employed, much mental work is taught, and handcraft training helps considerably in keeping the student's time occupied in the intervals of rest for the eyes.

School Children Examination:

Glasses are ordered more frequently than in the past. Although during 1926 in a series of 1268 new cases, glasses were ordered for only 356 patients. This is remarkable as there was no epidemic of conjunctivitis of note during 1926 and most of the children were referred following school inspection.

Thanks to an efficient school inspection, in Toronto, glaring cases of neglected eye conditions such as strabismus, high myopia and astigmatism, buphthalmos, rapid loss of sight due to retinal and choroidal disease or iridocyclitis are referred early to an oculist or to the ophthalmic clinics.

It still happens that some physicians have at times advised the neglect of a squint by saying, "Oh! never mind, it will get straight when the child grows up". In squints of low degree this occasionally happens but in those cases of higher degrees of refractive error, as the former squinting member loses central vision, it cannot be held straight after operation, and the regaining of even a low degree of stereoscopic vision is impossible.

It is important that every case of squint should be examined with the use of a cycloplegic and seen every three months at least, until straight, or until the case is progressing satisfactorily to recovery.

Children with strabismus always suffer from an inferiority complex resulting from critical remarks by playmates concerning their disability. The recovery of self confidence following the correction of a squint is notable. The squinting baby has a much better chance for regaining perfect stereoscopic vision than the squinting child. After the age of seven years complete cures are uncommon even if the eyes are perfectly straight after operation.

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RECENT RESPIRATORY STIMULANTS

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The type of case in which a respiratory stimulant is indicated clinically is usually accompanied by some circulatory failure. Respiratory stimulants at best have only a somewhat evanescent effect, and therefore lend themselves to use only over short periods of time, where they can serve to tide the patient over the crisis of some sudden respiratory and circulatory depression, until normal activity is again resumed.

Respiratory and circulatory depression, which can be beneficially treated by such stimulants, is usually caused by some toxin or poison acting on the centres, and is well exemplified by morphine poisoning. In a well developed case the respirations are very slow, stertorous or frequently shallow; occasionally breathing of the Cheyne-Stokes type occurs. The pulse is slow and gradually becomes very weak and finally impalpable. In other types of intoxications the respirations are very rapid and superficial and the pulse markedly accelerated, weak, thready, or even impalpable. The anaesthetics, chloroform, ether, and also the stronger hypnotics such as chloral hydrate, are only too prone to affect the heart and respirations unfavourably. Chloroform is, of course, the outstanding offender, but any of the anaesthetics or hypnotics when given in overdoses will produce similar results. In addition there must be mentioned all those substances frequently taken with suicidal intent, such as lighting gas, phenol, etc.

We do not here need to consider such therapeutic measures as the inhalation of CO_2, which affects only the respirations, or adrenalin and caffeine, whose primary action is on the circulation. The clinical effect of these substances is definite and well known.

Camphor has long held a clinical reputation as a stimulant in depression of the circulatory system or respiration, but the pharmacological evidence which has been adduced to support this claim has never been very satisfactory. Striking effects can be shown under certain conditions of experimental intoxication, but these have never seemed to justify the rather wide-spread clinical regard in which it has been held, particularly in Germany where it has been used in a wide variety of circulatory failures and also as a stimulant to the respiratory centre, particularly in cases of intoxication with morphine, the hypnotics and anaesthetics, or in the terminal stages of infectious diseases, particularly pneumonia. It cannot be said, on reviewing a large number of cases so treated, that the effects have been very striking or brilliant; the results have been irregular, for under apparently similar conditions, differing results were produced. To a large extent the failures have been ascribed to the extremely low solubility of camphor (1/1000) and the consequent

impossibility of getting it to the site where its effect was desired, either sufficiently rapidly or in sufficient concentration. The consequence has been more active study in recent years of possible substitutes for camphor.

Isopropylcyclohexanone

The first of these substitutes was suggested by Gottlieb and Schulemann. Chemical workers attempted to produce camphor derivatives which were readily soluble. The result of their efforts was the 3-isopropylcyclohexanone introduced under the trade name of hexetone. This substance is not very soluble in water but is readily soluble in a solution of sodium salicylate. It has now been very widely studied and quite frequently enployed in German clinics, and I think one may fairly say that it has the following pharmacological effects. It seems to have no effect on impulse production in the heart and little effect on cardiac contractility (Stross). It seems to have no effect in auricular fibrillation but seems to somewhat decrease sinus arrythmia and the production of extrasystoles. When it has been used in pathological conditions it has been noted that unduly fast hearts somewhat decrease in rate in many cases, while those of normal rate sometimes increase by a few beats (Krehl & Franz). As far as the circulation is concerned, its chief effect seems to be on the vasomotor centre which is undoubtedly stimulated (Gottlieb & Schulemann, Stross, etc.). This makes it useful in cases of collapse and in cardiac inefficiency due to lack of vascular tonus such as occurs so frequently in pneumonia, or as a terminal effect in the cases of severe poisoning with such drugs as the hypnotics or even morphine. The respiratory centre is undoubtedly stimulated and respiration improved. This is particularly evident when the respiratory centre has been depressed with morphine or the hypnotics (above & Leschke), and in poisoning by lighting gas (Taschenberg). Its effects on a respiratory centre depressed by chloroform are not so great if one may judge from the evidence as yet presented.

Part of the effect of hexetone on the respiratory centre seems to be due to the sodium salicylate present. Thus Modrakowski & Sikorski found that a similar quantity of sodium salicylate had as much effect in increasing the respiratory rate as did the salicylate solution of hexetone. Helaers confirmed these results but in addition showed that respiratory volume was much more affected by hexetone than by salicylate alone. Also he showed that hexetone dissolved in sodium benzoate, the benzoate having no action on the respirations, consistently produced definite improvement in the respirations. Thus we may conclude that hexetone itself acts as a respiratory stimulus, but that it is aided in this action by the sodium salicylate in which it is dissolved.

It has undoubtedly an effect on the cerebrum. Several observers have noted that the brain if confused or depressed becomes clearer (Krehl & Franz), and it is known that in larger doses in animals it produces convulsions which are of a cerebral type (Gottlieb). It may be given either intravenously 0.01 gms., or intramuscularly 0.2 gms., or in the same dose per os, and repeated every half to two hours in man,

even for a day or two (Krehl & Franz). It should not be given subcutaneously or in an oedematous area or in a fatty tissue, as then irritation or even necrosis may supervene, probably due to the sodium salicylate (Rominger, Julich). In intravenous doses, if not very slowly administered, it is apt to produce a state of anxiety with various sensations such as waves of heat and cold with sweating, and in consequence its intravenous use is better avoided save in cases where it is urgently necessary (Senner). The maximum effect occurs at the end of some 30 minutes when given intramuscularly.

Hexamethylenetetrazol

The second drug is one which departs very largely from the camphor constitution. It may be described chemically as hexamethylenetetrazol and has received the name of cardiazol (Schmidt, Hildebrandt, Krehl). This substance is readily soluble in water and in the usual solvents. Its watery solution can be sterilized and is neutral in reaction. On normal hearts it has little effect. If any occurs it consists in an increase in contractility with a decrease or no change in rate, and in various types of damage produced in isolated hearts, such as overstretching of the auricle, prolonged perfusion, the administration of chloral, quinine, chloroform, or lack of calcium, the effect is only on contractility (Stross). In many of these types of cases its effect is temporary and adrenalin and caffeine give better results. It appears to decrease the excessive cardiac irritability, as evidenced by abolishing extrasystoles produced by strophanthin (Schmidt, Hildebrandt, Krehl, etc.). In the intact animal it frequently decreases cardiac rate owing to a central vagus effect, especially if the rate is high. For the vasomotor centre it is the best known stimulant, surpassing strychnine, caffeine, atropine, and the other drugs mentioned in this paper. Its effect in raising blood pressure, when abnormally low, is greater than any of these others, though not so prolonged apparently as that due to coramin. It has been reported to relieve the spasm in angina (Hemmerling). Its effect in the respiratory centre when depressed, is very marked. It seems to increase the depth rather than the rate of respiration, though both seem to be increased in some cases. It has also some cerebral effects and patients are brought out of a cerebral depression due to hypnotic drugs, morphine and anaesthesia, relatively rapidly (Reuf, Voss). It increases the depth of respiration soon after the ending of a long anaesthesia, increasing the ventilation of the less active parts of the lungs and in consequence it is believed to have decreased post-anaesthetic pneumonia. Its effects in morphine poisoning are very marked. This we have seen in various experiments performed in this laboratory. For instance, a rabbit of 2 kilos, whose respiration completely ceased with 28 mgm. of morphine and whose blood pressure had begun to fall owing to the accompanying asphyxia, was given 40 mgm. of cardiazol intravenously. This resulted in a prompt re-awakening of respirations at a relatively slow rate but gradually increasing depth which were maintained for a long period of time (half an hour) with an increase in blood pressure above normal and a marked increase in pulse

pressure. The cardiac rate was decreased. This animal was then given 160 mgm. of morphine intravenously (over five times the previous dose which produced complete respiratory depression) yet this amount only decreased the rate of respiration and made it irregular with pauses, but for a period of another half hour this type of respiration continued with little or no failure in blood pressure or pulse pressure. In another animal similar results were obtained and it was noted that the intravenous injection of a small amount of adrenalin led to a prolonged increase in pressure and also to a marked acceleration in respiratory rate with a corresponding decrease in depth which was also very prolonged. In dogs when morphine is given in relatively large doses (10 mgm. per kilo.) the respiration is slow but deep; in this case the respiratory rate is increased and deepened by cardiazol and the animal awakes from his morphine sleep much more promptly. Cardiazol may be given subcutaneously 0.1 gm., or intravenously 0.05 gm., or per os (Schmidt, Hildebrandt, Krehl). In children $\frac{1}{4}$ to $\frac{1}{2}$ the adult dose may be given (Mertz & Eschbacher). These doses in an emergency may be repeated once or twice at half hour intervals and for long periods of time at two hour intervals.

In large doses cardiazol produces convulsions of a cerebral type in animals. This may also occur in decorticated animals and it re-awakes certain of the reflexes in deep narcosis (Schoen).

The diethylamide of pyridin-β-carboxylic acid (diethylnicotinamide) departs even further from the camphor structure. It is a colourless, almost odourless fluid, neutral in reaction, and is put up in a 25% solution in water, under the name coramin. On normal hearts it produces no effects save in large doses, when it produces decrease in rate and stoppage, but the contractility and conductivity over the auriculoventricular bundle are not affected even by these toxic doses. When damage is produced artificially in isolated hearts by auricular overdistension, prolonged perfusion, lack of calcium, presence of chloral or quinine, it produces no improvement and is not to be compared to adrenalin or caffeine. On hearts poisoned with chloroform it has little or no effect (Stross). It has little effect on the vagus centre but stimulates the vasomotor centre giving an increase of blood pressure in poisoning by chloral and morphine, and in cases of post-operative low blood pressure or collapse of various origins. Like cardiazol it improves the respiration after long prolonged anaesthesia. It stimulates the cerebrum in animals in large doses as evidenced by an increase in activity and tendency to bite, and in further large doses causes convulsions of a cerebral type (Schübel, Uhlmann). Some observers have also noted that there is a marked improvement in the appetite of patients receiving this medicament (Hirsch). It may be given either per os, intravenously, or subcutaneously, in doses of 1-3 c.c., two or three times per diem. It is quickly absorbed in all these types of administration. To children it may be given per os in milk (Hirsch). If repeated at the above frequency in animals there is no evidence of habituation being produced and in large doses there is, on the other hand, some evidence of increased susceptibility to its toxic effects, especially those on the heart in which

it produces a systolic arrest (Schübel). It has been used by numerous workers but it has not been compared for its effects on respiration with the other drugs. Nor does the literature as yet suggest that its action is as great as that of cardiazol, though it is perhaps a little more prolonged.

α-Lobeline

This drug was the result of a more careful study of the alkaloids of lobelia by Wieland and Meyer. It is an undoubted stimulant of respiration but is very transitory in its action. If injected intravenously it may cause quite alarming preliminary symptoms, cessation of respiration lasting two or three minutes, nausea with vomiting, sweating, and bradicardia, decreased blood pressure and colic. These are probably due to a stimulation of the vagus centre. It does not seem in any dose to improve the cardiac action nor to increase the blood pressure. In these respects it does not compare favourably with the above mentioned drugs, and further, the clinical cases reported have abundantly illustrated the evanescent character of its stimulant respiratory effect and the alarming symptoms that sometimes accompany its use.

All these drugs are still under investigation but at present there is not sufficient clinical evidence to warrant all the therapeutic claims set forth by their producers.

HEADACHES OF NASAL ORIGIN

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Headache is a symptom of disease and not infrequently, of obscure origin. It is the purpose of this paper to briefly point out the types of headache which are usually of nasal origin, and to make a concise review of certain headaches which are of significance from a Rhinologist's standpoint and which in recent years have been successfully dealt with from that point of view.

Headache of nasal type is due to an irritable stimulation of the dura, nasal cavities or sinuses either from pressure, congestion, toxaemia, or a reflex stimulus from irritation of the Trigeminal nerve or sympathetic nervous system.

The dura is innervated by these two systems and it is therefore necessary to recall as briefly as possible the innervation of the nasal cavities and sinuses, in order to explain the distant reaction of headache and forms of neuralgia which have originated in the nose.

Anatomy:

The nose and accessory sinuses are innervated by two great systems: (1) The nerves of common sensation, and (2) the sympathetic nervous system.

(1) The nerves of common sensation of the nose are derived from the Ophthalmic and Maxillary division of the Trigeminal nerve.

From the Maxillary division two or three nerve filaments, called the sphenopalatine nerves, are given off to the sphenopalatine ganglion. Some fibres of this root are axones of sympathetic ganglion cells but the majority are dendrites of cells of the Gasserian Ganglia. These pass mostly around the sphenopalatine Ganglion and follow the branches of this ganglion in the nose, but some are distributed to the ganglion itself, and supply its capsule with sensation.

From the Ophthalmic division is given off the nasociliary nerve which supplies the mucous membrane of the posterior ethmoidal cells and sphenoidal sinus, through the anterior ethmoidal and posterior ethmoidal nerves. The anterior ethmoid nerve supplies sensation to the anterior ethmoid cells and frontal sinus. The terminal branches of the anterior ethmoid nerve supply the mucous membrane of the ventral portion of the nasal septum as far as the nares and of the ventral portion of the lateral wall of the nasal fossa, including the ventral portion of the middle and inferior turbinates.

(2) Nerve impulses, which determine the calibre of the blood vessels and the mechanism of secretion, are transmitted by the *sympathetic* efferent nerves. The efferent or motor fibres for the supply of the nasal

fossa and sinuses are distributed by the great superficial petrosal nerve to the sphenopalatine ganglion, and nerve fibres arise from this station to supply vasodilator and secretory functions to the mucous membrane of nose, lacrymal gland, tonsils, etc. The other efferent fibres are located in the superior cervical sympathetic ganglion and reach their destination by way of the Trigeminal nerve. These also furnish vasodilator, vasoconstrictor, and secretory functions to the nasal mucous membrane. The afferent fibres have their cell stations mainly in the geniculate ganglion and are distributed to the nose by the great superficial petrosal nerve, which joins the great Deep Petrosal nerve (originating from the carotid plexus) to form the Vidian nerve which in turn enters the sphenopalatine ganglion.

The Venous Supply:

The veins of the nose form a network in the deeper parts of the tunica propria of the nasal mucous membrane, which assumes an erectile character over the respiratory region of the middle and inferior turbinates and parts of the adjacent portion of the nasal septum.

The venous blood is returned from this network dorsally into the sphenopalatine vein, ventrally into the anterior facial vein and cranially into the ethmoid veins. This latter channel possibly accounts for some of the dull heavy feeling noticed by patients with congestion in the ethmoidal area. These ethmoidal veins communicate with the veins within the dura.

A general classification of headache may be found in any book on differential diagnosis. Under the heading "Special Senses" in French's Differential Diagnosis, are mentioned headaches of sinus origin. And it is this phase I take the liberty of enlarging upon in accordance with the more recent conceptions of this malady. Nasal headaches can be classified as:

I. Hyperplastic and Suppurative.

II. Non-suppurative.

Under the latter class are included the Vacuum Frontal headache of Sluder fame and the Nasal Ganglia (sphenopalatine) syndrome.

Part I

Headaches of Nasal origin with Suppuration or Hyperplasia.

Headache is a frequent symptom of diseases of the accessory sinuses. Sinus headache shows a variety of forms. It is sometimes of a neuralgic character and at other times may assume a diffuse form not following the area of distribution of any one nerve. It is therefore apparent that sinus headache may imitate similar ones due to general and organic diseases and it is difficult at times to classify the pain. Nasal discharge may exist and prove to be of sinus origin, but the accompanying headache may be due to a chronic nephritis, etc.

Can we recognize these sinus headaches by their character alone? A careful Rhinological examination with consideration of all the symptoms presented is essential. Those occurring with great inconstancy, periods free of headache alternating with intense attacks of pain, suggest an

exacerbation of a chronic empyema of a sinus and may be due to a damming back of the secretion from closure of the sinus ostium. These patients have a type of headache often diagnosed as habitual headache of idiopathic origin and go through life without anyone realizing the possibility of sinus involvement, since there may be no annoying nasal symptoms or tenderness over the sinus walls. The latter condition was looked upon by many as a necessary accompaniment of sinus disease.

Owing to the similarity of headaches associated with acute and chronic inflammation of the sinuses, the malady will be dealt with under these two headings: A. Headaches in acute inflammations of the sinuses; and B. Headaches in chronic inflammations of the sinuses.

A. Headaches appearing in *acute* sinus inflammations are of a neuralgic like character or occur as sinus wall pains.

The neuralgic pains associated with an acute sinus inflammation are characterized by their daily onset and limited duration. They will usually develop before noon and last for from one to three hours and disappear, only to recur on the following day in a similar manner. They are often relieved by phenacitin or aspirin and numerous headaches of this source, arising during an attack of influenza and persisting, have been mistaken for the true neuritides in the distribution of the trigeminal nerve. Rhinologists of many years experience have gone so far as to state that no case of "Influenzal Neuralgia" has come under their observation which has not had an acute inflammation of an accessory sinus as a cause. It is of interest to note that these authorities have not found real neuralgia such as tic douloureux to be associated with sinus disease.

Constant pains in the region of the affected sinus wall are often present in acute inflammation of these cavities and often exist without the neuralgic pains just described. A characteristic of these pains is the associated tenderness of the sinus wall to pressure and palpation. This type of pain is indicative of stagnation of secretion within the sinus or bony involvement of the sinus wall.

B. Headaches, developing in the course of *chronic* inflammation of the sinuses, are mostly of a diffuse and indefinite character.

Generally speaking, chronic sinus headaches are of a diffuse character and show great irregularities both as regards intensity and duration but are fairly constant as to location. For many days or weeks the patient may be entirely free of pain and headache, only to be followed by a return of the discomfort which again lasts for a varying period. Physical exertion, mental excitement, indulgence in alcohol and tobacco may be contributing factors.

The localization of these headaches according to the particular sinus involved is again subject to great variations. A frontal headache may be due to involvement of frontal, ethmoid, antrum or even sphenoid sinuses, and the definite location only discovered after careful rhinological examination. However, the pain usually remains in the same place, *i.e.*, forehead, vertex or occipital region. If an acute exacerbation

occurs, the pain then changes to the neuralgic or the sinus wall variety described under the acute inflammatory type. These rules are subject to great variations and must be carefully weighed before definite conclusions can be drawn.

A word may here be said with regard to the types of headache and pain often associated with the individual sinuses.

An empyema of the *Antrum* may occur without any pain or headache. But in certain forms, such as those of dental origin in which severe periodontitis of the alveolar process precedes suppuration of the antrum, and in those antral empyemas associated with Influenza, a painful sensation of tension is often present in the region of the superior maxillary bone, *i.e.*, the sinus wall pain. The pain is often felt in the frontal process of the superior maxilla over that part of the nose near the inner canthus of the eye and extending up over the frontal sinus. Sometimes neuralgic pains may be felt in the supraorbital nerve during the antrum attacks.

The *Frontal* Sinus headache is a very constant symptom during an acute attack or in the course of an exacerbation of a Frontal Sinusitis. It is usually located over the anterior sinus wall and floor, and, although it may radiate over the whole side of the head, it is most intense at this point. It comes on when the patient rises in the morning and is gone in an hour or two only to return on the following day. The sensation is one of tension or pressure in the frontal sinus which may radiate as described above. The pain is due to a temporary retention of the pus in the sinus cavity which gravitates through the swollen ostium when the patient assumes the upright position thus placing the ostium at the lowest part of the cavity. These pains may often be aggravated or brought on by reading, writing, mental work, or use of alcohol or tobacco during these inflammatory periods.

With involvement of the *Anterior Ethmoid* cells all the pain and headache described in connection with the frontal sinus may be present. That this pain is due to negative pressure in the frontal sinus from obstruction of its ostium is not an unlikely explanation, but it is not the purpose of this paper to discuss these controversies. The anterior ethmoid pain is usually felt as a severe pressure over the root of the nose which extends upward over the whole forehead and may be of great intensity. In suppurative inflammation of the anterior ethmoid, this pain and headache occur during an acute inflammatory attack or with an exacerbation.

The *sphenoidal* headache is very inconstant even in the acute attacks or during an exacerbation. When present during these attacks, it may, however, be very intense and is usually described by the patient as a sense of pressure felt in the occipital region (even with some stiffness of the neck), or behind the eyes or deep in the head. The location of this headache varies greatly in different cases and has even been felt in the supraorbital and temporal regions. The one constant factor found as a rule is the persistence in location of the pain. It is nearly always felt in the same place with each succeeding attack. Neuralgic pains are not infrequently absent.

PART II

Headaches of nasal origin *without suppuration* have been brought into special prominence in the past few years by a careful investigation extending over many years and attended with some brilliant results. The name of Sluder is familiar to Rhinologists at the present day as one who has helped to bring some order out of chaos and, although results have not been all that could be desired, they have made progress in the right direction and stimulated interest for further investigation in this direction. It is hoped, in the future, that these studies will help to explain many more headaches of obscure origin.

Sluder classifies these non-suppurative headaches of nasal origin under the following two divisions:

(1) Closure of the Frontal Sinus without suppuration or Vacuum Frontal Headache.

(2) The syndrome of Nasal (sphenopalatine) Ganglian Neurosis.

(1) Vacuum Frontal Headache: This headache is of a low grade and fairly constant. It is made worse by use of the eyes and is not accompanied by any increase in nasal secretion which is almost a constant symptom in the headaches already discussed.

The diagnostic sign present in these cases is a definite tenderness on the floor of the affected sinus at a point which was originally noted by Ewing and is now known as "Ewing's Sign". To be exact, it is a point of tenderness situated at the upper inner angle of the orbit internal and posterior to the pulley of the superior oblique muscle. There are somewhat diverse opinions as to the cause of this pain. Sluder considers it due to closure of the Frontal Sinus ostium with resulting absorption of air within and negative pressure. This leads to headache and a tenderness over the floor of the sinus. Any anatomical configuration in the region of middle meatus and anterior ethmoid area, causing undue narrowness and thus leading to obstruction on slight swelling of the mucous membrane, would make this type of headache much more liable to occur.

On examination of these cases, this undue narrowness in the area of the middle meatus is usually found. Sluder even goes so far as to state that closure of the Frontal Sinus gives Ewing's sign and that this is not found in headaches produced by "ethmoidal or sphenoidal sinuses, ocular, digestive, gynaecological, renal, gouty, neurotic, or any other cause except empyema of the frontal sinus." This statement is somewhat sweeping but serves to impress the importance of investigating the nose and sinuses in all headaches of unidentified origin.

A somewhat similar headache is found with closure of the anterior ethmoid labyrinth but is treated along similar lines and will not be enlarged upon at this point.

(2) The Syndrome of Nasal (Sphenopalatine) Ganglia Neurosis: It will be remembered that this ganglion is a small triangular reddish gray body situated in the upper portion of the sphenomaxillary fossa giving off numerous nasal branches, which run through the sphenopalatine foramen, adjacent to the posterior tip of the middle turbinate. (The

ganglion derives sensation from the Maxillary Division of the Fifth and Sympathetic supply mainly from the Vidian).

This Syndrome of symptoms is produced by irritation of the (1) nerve endings in the nose, (2) the ganglian proper, or (3) the Vidian nerve as it courses along the floor of the sphenoid sinus before entering the ganglion.

The resulting symptoms fall into two classes (1) The neuralgic syndrome and (2) the sympathetic syndrome.

(1) The Neuralgic symptoms in a typical case begin as a pain at the root of the nose and about the eye. This increases in intensity and spreads backward over the side of the head to the occiput. Very often pain is felt in the ear. The discomfort may then spread down the side of the neck and arm even to the finger tips in the most severe cases.

(2) The Sympathetic Syndrome is a vaso-motor and secretory phenomenon. It may be the only symptom of this ganglian syndrome but, as a rule, is associated with the neuralgic element as well.

The patient is seized with sneezing and a hot watery discharge pours from the nose making the use of many handkerchiefs a necessity. The mucous membrane of the nasal cavities is hypersensitive and the external nose swollen and red. The pupil is often dilated and the eyes red and watery. The attacks come on irregularly, regardless of the season of the year, and tend to recur. There is usually a neuralgic element associated, although it may be easily overlooked by the patient and put down to rheumatic pains in shoulders, etc., and therefore in his opinion having no association with the nose.

The treatment of this nasal ganglian neuralgia is, briefly, to relieve, the source of irritation and directly treat the irritated nerve or ganglion.

Summary

The foregoing description of nasal headache and neuralgia has been given with the idea of presenting a subject of growing importance in the field of medicine. I have tried to describe these headaches in sufficient detail to be recognizable in a general way clinically. The more detailed examination and findings by the Rhinologist have been omitted, as being non-essential to the object in view and unnecessarily tedious to those not specially interested in the technical side of the subject, both as to rhinological findings and treatment.

The general character of the headaches in the suppurative class has been described and their somewhat erratic location and behaviour dealt with. The non-suppurative class has been grouped as such, with the object of emphasizing a type of headache which may exist without the usual nasal symptoms to direct attention in this direction. This division of nasal headache has seemed the most practical one to make in discussing this subject.

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EDITORIAL - - - - - - - - 1

THE RELATION OF THE BASIC MEDICAL SCIENCES TO SURGERY - - - - - - - - 2
WILLIAM J. MAYO, ROCHESTER, MINN.

UNIVERSITY OF TORONTO PRESS

LISTER DAY—APRIL 5TH, 1927

The Centenary of Lister's Birth

To Dr. John Stewart of Halifax, Nova Scotia, a former house-surgeon of Lister, must be given the credit of having taken the initiative in establishing "Lister Day" as an annual event. At his suggestion the Canadian Medical Association undertook to further the project and a circular letter was issued to the profession, signed by Dr. Stewart and the president-elect, Dr. F. N. G. Starr, advocating the institution of Lister Day. The Secretary of the Canadian Medical Association passed the suggestion on to the Secretary of the American Medical Association, and through this channel the idea was sent broadcast throughout the United States. As a result we learn that on the 5th of April, Lister Day was widely observed over the entire North American continent.

In celebration of the centenary of Lister's birth the University of Toronto had, as their guest, Dr. William J. Mayo of Rochester, Minnesota. At eleven o'clock in the morning Dr. Mayo delivered the first Balfour lecture to a large audience in Convocation Hall, consisting of some two thousand persons, including students, staff and the general public. The body of the hall was occupied by the students, the general public were in the galleries, and the staff were assembled in academic costume upon the platform. His Honour the Lieutenant-Governor of Ontario, the Premier of the Province, and the Chancellor of the University of Toronto were with the staff. The President of the University was unavoidably absent. It is of special interest to note that with the Faculty were Dr. F. LeM. Grasett and Dr. E. St. George Baldwin, both of whom had been house surgeons of Lord Lister. The lecturer was introduced by the Chairman of the Board of Governors, the Honourable Dr. Cody, who spoke of the significance of the event which was being celebrated. He also announced that it had been determined to have the Donald Church Balfour lecture on Lister Day as an annual event in the future. This lectureship has been established through the generosity of one of our former graduates, a Canadian by birth, Dr. Donald Balfour, who is now a surgeon of international repute in the Mayo Clinic at Rochester.

Dr. Mayo chose as the theme for his lecture, "The relation of the basic medical sciences to Surgery". This lecture, which will also be published *in extenso* elsewhere, was listened to with intense interest. It consisted of an analytic study, with an historic setting, showing the relationship between scientific discovery and the progress of medicine and surgery. Dr. Mayo paid a tribute to the work and life of Lister, linking his name with that of Pasteur and referring to them as "two men whose work stamped out the plagues of infection and communicable diseases and added thirteen years to the average lifetime of man."

On the evening preceding the lecture, His Honour the Lieutenant-Governor of Ontario, entertained a large gathering of representative citizens at dinner to meet Dr. Mayo. On Lister Day the Dean of the Faculty of Medicine had a luncheon at the York Club with the lecturer as his chief guest.

THE RELATION OF THE BASIC MEDICAL SCIENCES TO SURGERY*

William J. Mayo,
Rochester, Minnesota

The establishment of the Donald Church Balfour Foundation for annual lectures on topics related to surgery is evidence of the sincere desire of a distinguished alumnus of the University of Toronto to express in concrete form gratitude for the education which has enabled him to follow his life work.

It is especially fitting that the time chosen for the initial lecture on this foundation should be the hundredth anniversary of the birth of one of the world's greatest benefactors, Joseph Lister, and that annually in the years to come the Balfour lectures on surgery will be given at this time.

The Foundations of Medicine

If we turn back to the scant historical records of ancient Egyptian civilizations, Egyptian from the geographic rather than from the racial standpoint, because men of many races from the Near East groped for knowledge in Egypt, we find that in 10,000 years there were no less than eight complete relapses into barbarism. As one after another of these ancient civilizations have been uncovered from the sands of time, much of interest to early medicine has been revealed, but little of distinct value applicable to present-day methods employed in medicine.

In the days of the Ancients the dangers man could see with the unaided eye were those of large dimensions, wild animals, serpents and tempests, relief from which lay in physical action. The dangers which were not visible were considered visitations of unfriendly spirits, and from them the people prayed to their gods for relief. Occultism, the mother of cults, was rampant. Belief in fairies, ghosts, spirits, gods, and devils was the forerunner of belief in the reincarnation of the dead, and communication with the departed, exemplified in the modern spiritualistic seances. The various cults come and go as the frauds of the old are discovered and replaced by the frauds of the new, always with appeal to the emotions and prejudices of the unenlightened.

The early history of scientific medicine was greatly influenced by Greece, because Greece contained maritime ports which anabled all the evidences of early civilizations to be brought to her doors.

Is it any wonder that Aristotle, the Greek (B.C. 384-322), the first of the great physicians, the tutor and medical advisor of Alexander the Great (B.C. 356-323), should be looked on as the originator, one might say, of medical science? On the death of Alexander his empire of the then known world resolved into various fragments, and Egypt and the Near East, which had given through the Phoenicians the alphabet and through the Babylonians the sidereal year, under the Ptolemies collected from the known civilizations a great library and museum in the city named for Alexander on the Mediterranean delta of the Nile.

We think of the Ptolemies who ruled Egypt for 300 years chiefly for the last of their ill-fated line, Cleopatra, whom Shakespeare immortalized in his great drama, "Anthony and Cleopatra," but let us

*The initial lecture on the Donald Church Balfour Lectureship in Surgery, the University of Toronto, Toronto, Ontario, April 5, 1927.

not forget their great service to science. It was in Alexandria that the students of Aristotle in the Ptolemaic school of learning gave to the world scientific methods based on original investigations, the gathering of facts at first hand and relating them with natural phenomena. Is it remarkable that this beginning of scientific methods from which true knowledge sprang should have controlled scientific thought for 2,000 years?

The Sixteenth Century was pregnant with new developments. It was the age not only of Elizabeth (1533-1603) and Shakespeare (1564-1616), but also of Francis Bacon (1561-1626), who gave to the world inductive logic which, paralleling deductive logic, introduced experimentation and developed scientific imagination, the building of images to be compared with facts that were known.

It was in this period that the second great figure in medicine lived and worked, William Harvey (1578-1675), the father of physiology. We think of Harvey as the discoverer of the circulation of the blood, but his work went away beyond the discovery of isolated facts. He was an anatomist as well as a physiologist. He recognized that one purpose of the pericardium was to protect the heart from bursting during violent physical strain; recognized that the peculiar twisting motion of the heart was to enable its cavities to empty themselves of the blood they contained, as a wet cloth is freed from water by wringing. All of the scientific undertakings of Harvey were characterized by the same logical association of facts that he manifested in his observation of the circulatory system.

It should not be forgotten that contemporaries of Harvey were John Mayow, the first of the physician-chemists, whose work led to the discovery of oxygen, and Sydenham, the master clinician.

From this fertile age came the first crude form of the microscope, introduced by the Janssen brothers in 1590, the most significant scientific contribution of all time, destined to change the history of mankind. The cerebrum of man was built up coincidentally with the eye, and it is this fact, not the mechanics of the eye, that has made intellectual progress possible. In the lower vertebrates an expanded olfactory ganglion was the forerunner of the cerebrum, and the sense of smell not only controlled their behaviour, but remains in the lower animals the only special sense which is not relayed through intermediate ganglia. The great expansion of the cerebrum in man, however, completely overthrew the dominance of the olfactory sense, giving control to vision, and established direct relationship with consciousness, thereby governing behaviour.

Nevertheless, the sense of smell, by reason of its direct connection with the cerebrum, remains, even in man, the most delicate of all the special senses, being able to detect with marvellous accuracy colloidal and molecular substances suspended in the air as gases and vapours beyond the possibility of detection by artificial means. The senses of hearing, taste, and touch are secondary in that they reach consciousness indirectly, and only when trained by the eye do they reach perfection.

From the time of Harvey it was nearly 200 years to that of John Hunter (1728-1793), the third outstanding figure in medicine, who became not only an anatomist and a physiologist, but also a pathologist, and, for the first time in the world's history, correlated and related the isolated facts of scientific medicine into a coherent whole. The Hunterian Museum of the Royal College of Surgeons of London, with its thousands of specimens prepared and labelled in black by John Hunter's own hands,

testifies to the industry and the scientific imagination of this man to whom was given the power of seeing man as a physiologic unit.

We must not pass by with too scant mention William Hunter, the elder brother of John Hunter. In the next 200 years many of his almost forgotten contributions to physiology proved to have been made with the vision of the prophet. While the great chyle vessels were known, it was William and John Hunter who first described the lymphatic system and traced its minute subdivisions. The Hunters in their dissections had the incomparable advantage of a crude form of microscope and the hand magnifying glass which enabled them to follow the course of injections of dyes into vascular and lymph channels. Belchier, of Guy's Hospital, in 1764 had introduced madder dye for this purpose.

One hundred years later were born two men whose work stamped out the plagues of infections and communicable diseases and added thirteen years to the average lifetime of man. These two men, Pasteur (1822-1895) and Lister (1827-1912), whose birth we celebrate to-day, may well be considered together. With the advantage of improved microscopes and the development of staining and cultural methods Pasteur, of France, proved his theory of the origin of disease in micro-organisms and changed the whole aspect of medicine. Lister, of England, related micro-organisms to infections and putrefactive processes and developed methods of prevention which were to be the greatest gift made by man to surgery. Owing to the discoveries of Lister, hospitals for the first time became safe. Previously suppuration and gangrenes had caused so ghastly a mortality that patients were safer operated on in the forest than in the hospital.

As one considers the pioneers in medicine one recognizes in Aristotle the development of knowledge through scientific methods; in Harvey the foundation of physiology and anatomy; in Hunter the correlation of the basic sciences in relation to medicine; in Pasteur the determination of micro-organisms as the cause of disease; in Lister the sound application of the new knowledge to the cure and prevention of diseases of man.

These heroic men whose life work marked epochs in medicine we think of as individuals, but what they accomplished singly was perhaps of less importance than the inspiration they gave to the group of men who followed them.

Physiology and Anatomy

Life is a struggle for food, and changes in the habits and in the form of all animals are adaptations for the purpose of obtaining food. It has been well said that anatomy has been studied from the dawn of history, not for love of science, but because of fear of death, in an endeavour engendered by fear to understand the causes of death that they might be obviated.

Charles Darwin (1808-1892), in that remarkable series of deductions to be found in his "Origin of Species," laid the foundation for the practical study of evolution through investigations of embryology and comparative anatomy.

The basis for science in medicine fundamentally is anatomy. Physiologic requirement is the architect, but anatomy is the master builder, and the evolution of physiology must be studied in anatomy, embryology, and comparative anatomy. This is well shown in the Ptolemaic school, in which anatomy of all living things was first related to the study of

medicine. Harvey was a student of Fabricius at Padua, and his love for anatomical dissection is apparent in his accurate descriptions of anatomy. John Hunter, the Scotsman, was an anatomist primarily, and to his genius we owe the general conception of the cure or alleviation of pathologic conditions in man by careful surgical dissections.

Anatomy has been the foundation of surgery, and in no place has the tradition of the anatomical basis of surgery been more carefully followed than in Scotland, where to-day, as in the past, are made the finest surgical dissections in the world.

Up to the time of William Sharpey, an English anatomist (1802-1880), anatomy and physiology were taught together. Elliott Smith well says that it was a misfortune that the students of this splendid anatomist separated physiology from gross anatomy and carried microscopic morpholog into the teaching of physiology. Merely that the anatomical picture was microscopic did not justify separation of cause and effect.

Early in the Nineteenth Century we find evidence of greater interest in histology, especially in Germany. Schneiden and Schwam in 1838 first described the cell, which Virchow (1821-1902) said was the unit of life. And to Virchow and his school through the cell theory we owe a newer and better understanding of anatomy and physiology, although Virchow developed his theory from that perverted physiology which he called cellular pathology. The greater part of this new knowledge came from the study of material obtained at necropsy. However, while dead-house pathology gave an enormous amount of knowledge, it did not lead to rapid improvement in therapeusis. The physical changes resulting from terminal causes such as infections so often obscured the early disease manifestations that postmortem study gave little understanding of the disease in its curable stages. These early pathologic changes Sir Berkeley Moynihan has well described as "the pathology of the living". Interpretation of pathology of the living is the outstanding feature of modern medicine.

Biochemistry

The mind of man is a visual mind. The outstanding fact in the history of medicine is that the visual method of obtaining information has been dominant. To make visible the unseen in physics and chemistry is the task of scientific medicine.

Bayliss well says that there is no dividing line between physics and chemistry; that only under certain physical conditions can there take place the atomic interchange in the molecule called chemistry.

The unit of life is no longer the cell, but the ultramicroscopic entities called colloids, lying between the microscopic limit of 1/10 micron or 1/250,000 inch in diameter and 1/1000 micron or 1/25,000,000 inch in diameter.

We must not forget that anatomy as truly concerns the invisible colloidal, molecular, and atomic structures of the body as the visible gross structures, and that these minute constituent particles are controlled by the same physiologic laws. Our knowledge of these ultramicroscopic structures dates back to the early period of the Nineteenth Century and is due largely to three men. Brown (1773-1858), the English botanist, in 1827 pointed out that when a pencil of light was thrown into a dark room there would be seen in rapid oscillation certain motes of light of which there was no other physical evidence, and that

this phenomenon could also be seen with the microscope in certain fluids. The dancing motions of these light motes were called the Brownian movements. Dalton (1766-1844), working at the same period with so little scientific apparatus as to be one of the wonders of the scientific world, propounded his atomic theory, and in connection with his work the vibratory movements of the particles first observed by Brown were given the name of the dance of the molecules.

It was not until 1861, however, that the real significance of these motes of light was elucidated by Thomas Graham (1805-1869), Master of the Mint in London. Graham conceived the idea that these light motes were reflections of minute bodies which, while invisible, were larger than a ray of light, and so acted as mirrors to reflect the light. The rays of light travel 186,000 miles a second, but when refracted or reflected by an object their speed and length are changed and the rays become manifest as colours in the lines of the spectrum. The longest ray appears to the retina as red, and in order of the length and speed of the rays, orange, yellow, green, blue, and violet are seen. On the relative length of these rays is based the colorimetric system which to-day plays a most important part in the newer medicine. The ultraviolet ray, which is too rapid to be detected by the eye, stimulates physiologic activity, whereas those vibratory rays which are longer and slower than the red give rise to heat.

Graham further observed that these minute bodies which reflected light would not pass through parchment paper, nor form clear solutions. Because these bodies in the mass felt sticky, owing to their enormous surface tension, they were given the name of "colloids", a Greek term meaning glue. Graham also noted that certain other substances, such as the crystalloids, for instance, sugar and salt, which would pass through parchment, formed clear solutions. The crystalloids, representing the molecular constituents, were smaller than the ray of light, and therefore did not refract light. These experiments in a general way gave the early boundaries of the molecular field.

Scientific application of these methods, using the X-ray, which is only 1/100,000,000 inch in vibratory length, permitted the examination of the atom itself and led to the discovery of the electron and the proton. The proton is the positive nucleus of the atom around which the electron revolves in rapid motion. It was Moseley, that brilliant young Englishman who lost his life in the Gallipoli campaign at the early age of twenty-eight, who saw the significance of these facts and who showed that there were ninety-two possible elements between hydrogen, the lightest, and uranium, the heaviest, and that between each two elements in the progression of atomic weight there was approximately the weight of one or more atoms of hydrogen. Wherever there was a gap a new element would be discovered; all but two of the elements are now known.

Anatomy and physiology have thus been traced to the electron and the proton. The actual exchange of electrons and protons in the atom alters the constitution of the molecule, and upon this alteration life depends.

Oxidation

Heat and energy to drive the human machine depend on oxidation, the union of oxygen with other elements. The hydrogen activation theory of Wieland is perhaps the best explanation of the process of oxidation. The great source of energy for the human body is carbon,

in which the heat of the sun is stored through the agency of the mechanism furnished by chlorophyl, the green colouring matter of plants. When the carbon is oxidized, the carbon dioxid (CO_2), which represents the ash, is eliminated by the lungs.

The power of the sun which is used in breaking up molecular compounds containing hydrogen remains latent in the hydrogen atom, and when this power is released by oxidation, which rebuilds the hydrogen molecule, heat and energy are available for vital needs. The ashes of this action, if one may so speak, are represented by water (H_2O).

Foods are classified in three groups: carbohydrates, fats and proteins, and all contain carbon, hydrogen and oxygen. The higher the oxygen content the more rapid the oxidation. The fats (glycerin stearate, $C_{57}H_{110}O_6$), have a higher oxidizable molecular content, and therefore more heat and energy, than carbohydrates, represented by glucose sugar ($C_6H_{12}O_6$), but burn more slowly because of a relatively lower oxygen content. In addition to the carbon, hydrogen and oxygen, the proteins contain nitrogen, which gives form to the tissues by permitting the deposition of other elements, such as calcium and phosphates, and a little sulphur. The nitrogen is not combustible, and when it has served its purpose it is thrown out of the body as urea, an ash, which, if present in excess in the blood, has grave consequences.

Kendall has shown that an atom of sulphur in the catalyst acts as a thermostat which holds the heat of the body at 37° C. A pound of sugar burned outside the body will produce the same amount of heat as a pound of sugar burned inside the body, but only at a temperature above 400° C.

Metabolism

The essential alkalinity of the bodily tissues is slight. This alkalinity has been compared to the difference between tap water and distilled water, and at that distilled water must be fresh or it would absorb sufficient acid from the carbon dioxid in the atmosphere to upset the alkali acid balance. An excess of alkali in the blood, called alkalosis, is now known to have as serious effect as diminution of alkali, badly named acidosis, because an acid reaction in the blood is incompatible with life.

Among the constituents necessary to life are salt and iodin. These two elements are a heritage from the water vertebrates. Iodin, like salt, is soluble and easily washed out of the soil, and is closely concerned with vital metabolic changes. The discovery of thyroxin by Kendall gave not only insight into but a tremendous impetus to the successful management of goitre.

Seventy-five per cent. of the body weight is due to water. There is as much water in the muscles as there is in the blood, but in different colloidal combination. Carbohydrates, fats, and proteins in a molecular form are carried in the bloodstream. The arterial blood contains $18\frac{1}{2}$ per cent. by volume of oxygen. Krogh and Haldane have shown that in man at rest, each cavity of the heart expels about 4 liters of blood a minute. During violent exertion, to supply the necessary amount of oxygen to the tissues, the entire volume of blood passes through the heart and around the body every ten seconds, and the amount expelled by the heart each minute is increased from 4 to 24 liters.

Krogh showed also that during the systole of the heart there is sufficient dilatation of the arterial capillaries to open tiny ostia which permit the escape into the tissues of molecular food products with the

oxygen. The extraction of the heat and energy is the function of the tissue colloids, and the negative pressure in the veins draws the carbon dioxid into the venous channels for elimination through the lungs. In shock, sufficient dilatation of these ostia permits the blood colloids to pass out into the tissues.

"Rehabilitation"

Examinations of the secretions upon which sole reliance formerly was placed are now aided by examinations of the blood. The estimation of the blood sugar helps us to understand not only diabetes but also the relation of shock to subnormal blood sugar content. Suitable preoperative treatment of the patient with diabetes with that splendid product of Canadian research, insulin, has brought the operative mortality in these cases down to little more than the mortality in cases of patients without diabetes. The estimation of the blood urea is no longer guess work, but an accurate estimation of kidney function and is a guide to elimination of toxic substances. Creatinin estimations have their prognostic value. Through determinations of the blood chlorids and the carbon dioxid we get a clue to baffling conditions which formerly led to death.

All of these estimations either directly or indirectly concern vision. The discovery of the analine dyes by Perkin (1838-1907) led to a great advance in medicine. Rowntree and Geraghty made a splendid contribution to accuracy in medicine by finding that the molecule of the dye, phenolsulphonephthalein is the same size as that of urea and that it is eliminated through the kidneys in the same way. Visual methods of detection and measurement are now available. By further experimentation Rowntree found that the dye, phenoltetrachlorphthalein, when injected into the bloodstream is eliminated entirely through the bile. Later Rosenthal from this fact developed a valuable method of estimation of liver function. Graham and Cole have utilized Rowntree's discovery to develop cholecystography, working first with phenoltetrachlorphthalein, which in the gallbladder gave a faint shadow under the X-ray, later with the corresponding iodin and finally with the bromin substitution product of phenoltetrachlorphthalein.

Photography has enabled the eye to examine at leisure the phenomenon of motion in the ultramicroscopic field. One twelve-millionth of a second is sufficient to make a photograph which will show a bullet in flight at a muzzle velocity of 3,000 feet a second as though it were standing still.

All these are examples of our ability to analyze the individual in his vital processes as we would analyze in the test tube. The past generation solved the problem of communicable and infectious diseases, largely those of the first half of life. The present generations are solving the problem of the premature deaths of middle and later life caused by diseases of the heart, the lungs, kidneys, and nervous system, and cancer, the age long enemy of man, is on its way to defeat.

The new surgery concerns the rehabilitation of the patient so that surgical operations not only can be performed more safely, but also, by proper preparation, many patients heretofore considered beyond help can be brought into condition for life-saving operations.

The future of medicine depends on further study of biologic phenomena, which, after all, concern the fundamental sciences of physiology and anatomy.

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UNIVERSITY OF TORONTO PRESS

COURSES FOR GRADUATES IN MEDICINE

The Faculty of Medicine of the University of Toronto recognizes that the practioners of the Province are anxious to keep closely in touch with the advances in Medicine, and that they have a claim on the Provincial University to aid them in doing so. The Faculty considers this entails on it a duty second only to the instruction of the undergraduate.

At the present time the large amount of undergraduate teaching makes it impossible to offer during the academic session set courses of sufficient variety to meet all the needs of those who seek further study.

Those who have studied abroad know that the routine method is for the graduate to attend the instruction given to the students of the senior years in Medicine, to follow the ward rounds and to go to the out-patient department picking up what he can. The Faculty has opened the courses of instruction given to the higher years in Medicine to any one who cares to attend and refresh his knowledge in this way. A Standing Committee has been appointed whose duty it is to give any graduate interested, advice as to the clinics and lectures which should be taken and to confer with the heads of departments and individual teachers so as to arrange a course in advance for each applicant. Such a course may be modified by the committee if it does not prove suitable.

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Medicine.
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The University will impose a minimum fee of $25.00 per month. This will be imposed for any course of less than a month as a registration fee. Graduates attending courses will be charged a supply fee to cover the cost of materials or equipment supplied.

PROTEIN ASTHMA: ITS NATURE, DIAGNOSIS AND TREATMENT

H. K. Detweiler, M.D.

The following simple etiological classification of asthma is suggested as a basis for this discussion:—

1. Protein asthma.
2. Bronchitic asthma.
3. Cardiac asthma.

Protein Asthma: In 1906 Wolff-Eisner suggested the anaphylactic nature of the condition known clinically as hay fever. The relation of certain proteins, particularly those of pollens, to this disease seemed fairly obvious, and the method of demonstrating the sensitivity of the patient was so simple that it was not long before the theory was accepted generally. In 1910 Meltzer suggested that asthma might also be a phenomenon of anaphylaxis. He based his theory upon certain facts elicited in the study of anaphylaxis by Auer and Lewis working in his laboratory at the Rockefeller Institute. These facts may be enumerated a follows:

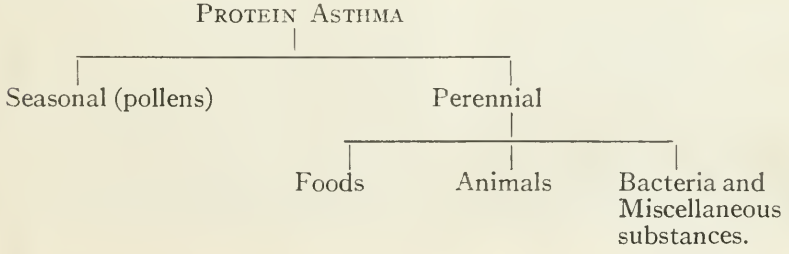
(a) In an anaphylactic attack the bronchi are constricted.

(*b*) The constriction is of peripheral and not of central origin.

(*c*) Atropine relieves the anaphylactic attack. He argued that these conditions undoubtedly obtain in asthma. He pointed out that they obviously were present in the asthma associated with hay fever, and it was his belief that they would hold for other forms of the affection.

Meltzer's theory was put to an exhaustive clinical test during the next few years, and while it has not been proved to hold in all cases of asthma, it has been amply substantiated in a large group of cases. Indeed it has served sharply to divide all cases into two great subdivisions: (1) those which are sensitive to protein; and (2) those which are not. The former are now regarded by careful observers as comprising the whole group of primary asthmatics, while the latter, or non-sentitive cases comprise a mixed group, composed chiefly of cases of asthma in which the primary factor is an infection.

Protein asthma may be subdivided into two main types on a basis of seasonal and non-seasonal incidence; the following table adapted from Walker will illustrate this:—



In an uncomplicated case of protein asthma the clinical picture of a severe attack would be as follows:—Upon exposure to the protein to which the patient is sensitive, there is usually a feeling of tightness in the chest, which rapidly grows more and more intense until the breathing becomes little more than a succession of quick gasps, followed by prolonged and wheezy expirations. The main difficulty seems to be in expiring the air, with the result that although all the muscles of respiration are brought into play, the expiratory act is so prolonged that the impulse to inspire comes before the chest has emptied itself. Thus each succeeding respiratory cycle leaves the chest with an additional amount of residual air. The net effect is that it is not long before the lungs are greatly distended, the diaphragm is low, the superficial cardiac dullness obliterated, and the whole chest is being held in an extreme inspiratory position. Fortunately, just as it would seem that the patient must suffocate, there comes a tendency to cough and a thick, tenacious, jelly-like material is brought up in increasing quantities. With the advent of this sputum, or probably just preceding it, the bronchial spasm begins to lessen and in a comparatively short time the attack has subsided. The whole cycle may last from half an hour to three or four hours, and there may be a succession of attacks with little respite in the intervals. Between the attacks, physical examination of the chest reveals no abnormality whatsoever, but during the attack, in addition to the signs already enumerated, there are to be noted hyper-resonance, prolonged expiratory murmur and numerous dry rales, mostly of high and medium pitch.

If at the height of an attack the patient is given a hypodermic injection of a few minims of adrenalin chloride 1-1000, relief is experienced in a few moments. Atropine has a similar effect, but the action is less rapid. It is generally assumed that the adrenalin acts upon the sympathetic nerve-endings causing a relaxation of the spasm of the bronchial musculature, and this relaxation has the effect of restoring the lumen of the bronchus concerned to its normal size. This view is supported by the findings in sensitized animals who have been given a second dose of protein with the production of anaphylactic shock. If the animals are allowed to die in anaphylaxis, post mortem examination reveals a marked spasm of the bronchial muscles. If, on the other hand, the dose of protein is not too large, and the adrenalin is administered, the anaphylactic condition is relieved and the respiratory embarrassment of the animal ceases in a manner similar to that of the human asthmatic.

Many observers believe, however, that the respiratory difficulty in human cases of asthma is not due to bronchial muscular spasm, but rather to the turgescence of the mucous membrane of the bronchial tree as a local effect of the protein to which the patient is sensitive. This turgenscence of the mucous membrane is claimed to be not unlike the local reaction of the skin upon the application of such protein to abraded areas. The proponents of this theory claim that the action of adrenalin in these cases is similar to its action in urticaria; that is, it acts upon the smooth muscle of the smaller blood vessels and on the contractile cells of the capollaries.

Diagnosis: It is well here to emphasize the importance of a careful history. According to Walker "four-fifths of the cases beginning their asthma in infancy are sensitive. Two-thirds of those beginning in childhood are sensitive, while only one-half of those beginning in young adult life, and one-third in full adult life give a positive test. When the asthma begins after the age of forty-five, practically none are sensitive." From this it is clearly evident that the history of onset aids materially in the diagnosis.

We have found that an accurate account of the first attacks, particularly with regard to whether asthma or bronchitis appeared primarily, is also of great value, especially in the patients with an onset after twenty years of age. In those with earlier onset, it is doubtful if the best clinical history can render unnecessary the carrying out of the protein tests to be described.

The physical examination of cases of uncomplicated protein asthma shows the chest held in the inspiratory position with diminishing excursion, deeper resonance, prolonged expiratory murmur and numerous dry rales. The breath sounds are frequently difficult to hear, partly by reason of the adventitious sounds which usually are very prominent, and partly by reason of the lessened air entry. Often this suppression of the breath sounds is heard more particularly over certain areas, suggesting, therefore, that the bronchial spasm or turgescence may be irregularly distributed, or that it has actually plugged the bronchus supplying the area referred to. Between attacks, in the uncomplicated cases, there is no abnormality to be found on physical examination of the chest. On the other hand, if the patient has been a sufferer from asthma for a considerable time, chronic pulmonary emphysema supervenes, accompanied by secondary bronchitis. In such cases, examination between attacks reveals the characteristic physical signs of this condition. At this stage the protein asthmatic resembles the patient with bronchitic asthma, and a differentiation becomes impossible from physical examination alone.

In the uncomplicated protein asthma cases the sputum is usually clear and jelly-like, and is only present during an attack, or for a few hours after. It therefore differs in its character from the sputum in the cases of bronchitic asthma, in which there is usually a yellowish or greenish type of sputum; in other words the sputum is of a purulent character from a pyogenic infection.

Finally, cases of protein asthma will show in nearly every instance a response to one or more of the cutaneous protein tests. A brief description of the technique of these tests follows:— A sufficient number of small abrasions are made upon the ventral surface of the forearm to accommodate the various proteins to be used. These scratches may be made with a sharp scalpel and should be about one inch apart, an eighth of an inch long, and need not be deep enough to draw blood. A drop of N/15 NaOH is placed upon each abrasion, and a minute amount of the protein powder rubbed into it. The first scratch nearest the bend of the elbow is left without protein to serve as a control, because it is occasionally found that the mechanical scratching of a sensitive skin will cause a small wheal to form. The proteins must be kept in solution by replenishing the

soda solution as it evaporates, and one-half hour should elapse before the test is complete, and the proteins removed.

In the average case of true protein asthma, it will be noticed within a few minutes that a red areola is appearing about one or more of the abrasions to which offending proteins have been applied. In the centre of this areola, about the scratch, a wheal will be observed, which gradually increases in size until its maximum is reached within thirty minutes. The smallest wheal which is considered positive, and therefore of diagnostic importance, is 0.5 cm. in diameter. Usually it is larger. A definite wheal less than 0.5 cm. in diameter, in the absence of any reaction at the site of the control abrasion, may be considered as suspicious, and worthy of further consideration.

The routine series of proteins for cutaneous testing should include the following representatives:—*Pollens;* June grass, redtop, timothy, orchard grass, ragweed, goldenrod and daisy; *Miscellaneous substances;* orris root and house dust; *Animal emanations;* horse dander, cat hair, catle hair, dog hair, sheep wool, rabbit hair, chicken, goose and duck feathers. Of the foods the following should be represented:—*Cereals;* wheat, oats, corn, rice and rye; *Meats;* beef, pork, lamb and chicken; *Fish;* salmon, mackerel, lake trout and white fish; *Vegetables;* potato, cabbage, spinach, cauliflower, onion, turnip, parsnip, lettuce and celery; *Fruits;* orange, tomato, apple, peach, prune and pineapple; *Miscellaneous foods;* milk and eggs.

Of the cases of seasonal asthma the large majority react to one or more pollens, and their symptoms of asthma are usually associated with those of hay fever. Of the non-seasonal cases of asthma the animal emanations appear to be the most frequent cause in adults, whereas foods, particularly eggs and milk, are the most frequent offenders in children.

In connection with dust it is important to realize that it may act in two ways, first by mere mechanical irritation; most asthmatics volunteer the information that inhalation of dust of any kind is apt to make them worse. On the other hand there are those who react to the protein contained in house dust extract. It is sometimes remarkable to note the specificity in these cases; certain individuals will react to the dust of a certain house and not to that of any other. In my experience, however, the majority of dust sensitive cases will have an attack wherever house dust is plentiful. The following case illustrates this type:—C.A.S., a commercial traveller, aged 42, consulted me in January 1925, because of asthma to which he was subject throughout the year. He was unable to offer any clue as to the causation. The test with stock house dust extract yielded a violent reaction. After discussing this feature of his case with him I was able to elicit the following interesting history: He frequently had attacks of asthma during the week days while on the road, but was always free, or nearly free from attacks while at home over the week-end. He always had severe attacks on visiting his mother. The explanation of this fact was that his wife was a very scrupulous house-keeper, so much so that he confessed he felt that she was a slave to her housekeeping. His mother was getting on in years and no longer supervised

the keeping of her house, and the servants allowed a great deal of dust to accumulate.

There are occasional cases in which the patient exhibits asthmatic attacks upon the ingestion of certain drugs. The commonest of these drugs are aspirin and quinine. Sometimes very severe reactions occur when these drugs are taken, and it is usually unwise to disregard a patient's statement that he thinks asthma is brought on by the taking of any given drug. I have seen several aspirin cases which had had severe attacks of asthma, but these passed off without serious results. However, cases are on record, such as Kern's patient who mentioned to her former physician that she was not able to take quinine. Curiosity, however, led him to give her a mixture containing 1/8 of a grain of quinine to the dram. Within a few minutes after the first dose the patient almost died of angioneurotic oedema with oedema of the glottis.

Treatment: Once the patient has been thoroughly investigated and the cause of his asthma ascertained, the treatment suggests itself in most instances. The investigation requires time, and where the attack of asthma is actually in progress, one's attention must first be directed towards affording the patient temporary relief. Unnecessary conversation as the effort of talking or other exertion on the part of the patient increases the respitatory distress and should be avoided. Adrenalin chloride (1-1000) given hypodermically in a dose of from 5 to 6 minims, according to the size of the patient, will usually relieve the attack. Atropine acts by paralyzing the vagus endings and in the few cases where adrenalin, which acts by stimulating the dilator fibres of the sympathetic, does not have the desired effect, or is contra-indicated for other reasons, atropine should be tried. Ephedrin Hydrochloride in doses of 25 to 50 milligrams every 6 hours usually has an action similar to that of adrenalin and has the advantage of being effectual when given by the mouth.

Prevention of Recurrences: Attacks of asthma can only be prevented with certainty when the cause has been discovered and removed. In the case of those asthmatics sensitized to protein this is often easily accomplished. Where the offending protein is contained in the food, such article of diet should be omitted since attempts to desensitize these individuals must necessarily be laborious and time consuming and are not always successful. Prolonged abstinence, however, will often result in automatic desensitization. In cases where it is impossible to omit a food from the dietary the desensitization is accomplished by one of two methods. One is to feed the patient minute quantities of the offending food—quantities insufficient to cause a reaction. The amounts are gradually increased until the patient is able to take a reasonable serving without untoward effects. The other method has only been available recently, namely, the inoculation of the patient with graduated doses of protein solution, after the manner of hay fever treatment. These solutions have only recently been on the market and I have had no personal experience with their use. Both of these methods are time consuming and must be persisted in to obtain satisfactory results. In the case of animal

emanations, avoidance of contact should be attempted; where this is impossible or insufficient, desensitization by inoculation with increasing doses of the offending protein will usually prove successful. In the writer's experience such active desensitization is most often necessary in the case of horse dander sensitivity, less frequently in cases sensitive to feathers. From what has just been said it is obvious that sensitivity to feathers and house dust is best treated by the removal of pillows, cushions and eiderdowns from the rooms and sometimes from all the living quarters of the house; and the most thorough house-cleaning, so as to reduce dust to the absolute minimum. Bare floors are more easily kept free from dust than those covered by rugs or carpets; draperies should be eliminated as far as possible. In other words it is sometimes necessary to convert the patient's house, and particularly the patient's room, into a veritable hospital ward so far as furnishings are concerned.

Pollen asthma is treated in the same manner as hay fever, namely, by inoculations with gradually increasing doses of the protein of the offending pollen *before* the season complained of. Such desensitization is not permanent, but must be repeated each year.

THE EMPHYSEMATOUS LUNG

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The numerous articles that have been written on the subject of emphysema show that investigators are by no means in accord regarding the etiology, or even the details of the morphology of this condition. Many believe that increased air-pressure within the lung is at least one of the causative factors; some claim it is the sole factor; while others hold that the trouble is due principally to some defect in the lung tissue, and that both mechanical causes and nutritive disturbances are at work, a vicious circle being thus established.

Eppinger (1876), and Kläsi (1886), each published an elaborate treatise on emphysema. Each attributes the increased size of air-spaces to stretching of alveolar walls, and believes that holes are torn in these walls, and elastic fibres ruptured, as a result of high intra-alveolar tension. Sudsuki, (1899), assumes that there are normally holes in the partitions between alveoli, and claims that in the stretching of the walls these holes are enlarged and made confluent. He denies that ruptures can be observed in the elastic fibres. Grawitz suggested, as a possible cause, defective blood supply to the tissue affected. Virchow did not believe emphysema to be a mere condition of inflation. He thought that the trouble was due to a weakness in the lung tissue, perhaps in the elastic fibres. He mentions that emphysema often has its beginning in early youth.

In 1921 Dr. Loeschke of Mannheim published a paper on the normal and emphysematous lung. He removed an enphysematous lung uninjured from the body, attached it by its main bronchus to a bellows, and allowed it to be blown up to its full expansion, employing the least possible pressure. He let it dry in the inflated condition, filled up the thoroughly dried lung with Wood's metal at 80°, and then removed the lung tissue by corrosion. His chief conclusions regarding the emphysematous lung are as follows: The non-respiratory bronchiole is mostly unchanged, but the respiratory air-passages have large dilatations. These large spaces often occur as a result of atrophy of the partition walls between two forking alveolar canals. There are numerous communications between adjacent air-spaces. The interalveolar tissue disappears more and more, and the alveolar canals change into sausage-shaped spaces, which communicate with one another and finally merge.

Osler states that he has been impressed by the frequency of the origin of emphysema in childhood, and by the markedly hereditary character of the disease. He speaks of a group of patients who, on inquiry, are found to have been short-breathed from infancy, and in whom he believes there has been a congenital defect in the lung tissue. He says that we are still ignorant of the nature of this congenital weakness. In speaking of the morbid anatomy, Osler notes that with a hand lens, remnants of inter-

lobular septa, or of alveolar walls, may be seen in the large emphysematous vesicles.

In considering the structure of the emphysematous lung, it will be well to remind ourselves of certain aspects of the architecture of the normal lung which are not emphasized in the text-books. In the diagram given below there are represented some of the terminals of a non-respiratory bronchiole from the lung of a thirteen year old child. At the entrance to the maze of channels is a short piece of non-respiratory bronchiole marked I. This divides into two respiratory bronchioles only one of which is followed. There follow a number of subdivisions, and finally the channel marked 6 is represented with all its ramifications. It will be seen that the diagram represents only a small proportion of the terminals of the non-respiratory bronchiole. Thus if the branch 4 had been completely followed, it would presumably have had as many ramifications as 6, so that our diagram would have been twice as large. Similarly, in order to represent all the terminals of 1, there would be required a diagram at least 8 times as complicated as the one shown in the figure. This diagram is based on a wax-reconstruction now in the anatomical museum of Toronto University. It was necessary to make the model in order to produce the diagram, but the latter has proved in some ways to be the more illuminating, for the branching being projected upon a single plane can be seen all at once. However, an inspection of the model serves better to give one an idea of the wonderful minuteness of the channels. The reconstruction was made at a magnification of 100 diameters, so that the model is one million times greater in volume than the lung tissue it represents. In the museum there has been placed beside the model, a celluloid cube of 1/13th inch side, which represents the volume of actual lung tissue in which occur the channels shown in the diagram. There is also in the museum a model representing the terminal air-spaces in the normal adult lung.

The making of the reconstruction demonstrated the absence of the "atrium" which is described in so many text-books, but more important than this was the demonstration of the extreme complexity of the air-passages, and the intricate manner of their interlocking. It was proved, too, that the system of branching is a closed system, there being no communications to form short-cuts from one branch to another.

Now in regard to the emphysematous lung, I have carried out a similar investigation, by means of wax-plate reconstruction. In doing this work, as in the case of the reconstruction from the normal lung, I have had the advantage of frequent consultation with Prof. J. Playfair McMurrich. A specimen of lung tissue was obtained at the Toronto General Hospital, the case being that of a man of sixty years, who had been the subject of emphysema of the ordinary hypertrophic type. The autopsy was performed soon after death, and the pleura opened according to the usual routine. A large piece of lung was removed and placed in Bouin's fluid. For sectioning, a small portion taken from near the pleura was used. After the usual preparation, the tissue was embedded in paraffin. Sections of 30 microns thickness were cut and mounted in series, afterwards being stained with Weigert's elastic tissue stain. A large respiratory

Diagram of some of the terminal ramifications of a non-respiratory bronchiole of the lung of a child, projected upon a single plane. All these branchings occur in a piece of lung about the size of a pin's head.

air-space about the middle of the series was now chosen and traced peripherally in all its branches. Proximally it became continuous with a non-respiratory bronchiole which, with another non-respiratory branch, formed a dichotomy. This other branch became continuous with a respiratory bronchiole which was traced to its terminals. In the completed reconstruction, the two systems of branchings are side by side. Thus in the upper part of the model there is represented a short piece of non-respiratory bronchiole, which divides into two branches, both non-respiratory. These are continued into two respiratory bronchioles, each of which ramifies into a series of respiratory air-spaces, all being represented in the model. This reconstruction, which was made at a magnification of 50 diameters, is in the museum of the anatomical department. A celluloid cube of 1/5th inch side, standing near the model, represents the volume of actual lung tissue in which all these branches are contained.

The reconstruction from the emphysematous lung demonstrates that the air-passages form, in the main, a closed system of branchings. Under the microscope the section of emphysematous lung gives the impression that there is a general breaking down of the walls of respiratory air-spaces, and that these spaces communicate freely with one another by numerous large openings in their adjacent walls. This picture in the microscope appears to be one of confusion, so that the task of reconstruction seems at first a hopeless one. As the reconstruction proceeded, it was found that this confusion was more apparent than real. All the ramifications of one respiratory bronchiole were followed to their terminals without any cross-communications being found. In the terminals of the other respiratory bronchiole, only four extremely minute perforations were discovered, and it is just possible that these were artefacts. They all occurred in one subdivision. Loeschke reports finding cross-communications of large size in great numbers, but his material was prepared by the corrosion method. The possibility of error in using the corrosion method may be realized if one considers how difficult it would be to get an accurate metal cast or mould of all the emphysematous air-spaces above mentioned, when they are contained in a cube of lung tissue of 1/5th inch side. There is no doubt that wax-reconstruction of the passages, on a greatly magnified scale, is by far the more accurate method.

It is commonly stated that in emphysema there is over-distension of the alveoli, with rupture of the alveolar walls, but such statements are open to question. In the examination of sections of emphysematous lung no evidence was found of direct rupture of elastic fibres in alveolar walls, though elastic fibres were abundantly evident under the microscope. In the reconstruction from the emphysematous lung the respiratory air-spaces are of course revealed as being enormously larger than normal, while the non-respiratory bronchioles are apparently unaltered in size. The same marked contrast is really before us when we inspect sections of normal and emphysematous lung under the microscope. Osler states that in ordinary emphysema the air-spaces vary in diameter from 0.5 mm. to 3.0 mm. In the normal lung the air-cells or alveoli have an average diameter of from 0.1 mm., while the channels into which the alveoli open

have diameters of from 0.2 mm. to 0.4 mm. It might seem reasonable at the first glance to attribute the difference in size to simple stretching of the walls of normal air-spaces. However, the difference is so enormous that such an explanation is incompatible with the fact that the enlargement of the chest accompanying emphysema is only a small proportion of the total volume of the lungs. Taking Osler's lowest figure, let us suppose that an alveolus in changing from the normal to the emphysematous condition, increases in diameter from 0.1 mm. to 0.5 mm., and that the dilatation is at the same ratio in all directions. Although the increase is one of only 5 diameters, the volume of the enlarged alveolus would be 125 times the normal volume. It is evident that even this degree of dilatation cannot take place to any extent in the lungs. Nor does it seem possible that there is sufficient dilatation to rupture the elastic fibres, or to tear holes in the alveolar walls. In compensatory emphysema, even if half the lung collapsed, the remaining air-spaces would not dilate to more than twice their normal size.

We are driven to seek some other explanation of the existence of large vesicles in the emphysematous lung. These large air-spaces must result from the merging of a number of normal air-spaces. Certain alveolar walls must be destroyed, but there is not an indiscriminate breaking-down of the partitions, for the system of branching remains a closed system. One might compare the process to the changing of a glove into a mitt. There is atrophy of that tissue in the lung which is represented by the layers between one's fingers in the glove. In the areas corresponding to the finger-ends of the glove, there is loss of continuity of many elastic fibres, capillaries and lymphatics. At the same time there is union of tissues to prevent "holes" being formed. (Such union would not be more extraordinary than the merging of layers of peritoneum in the development of the body.) Gradually the emphysematous spaces, formed in this way, are themselves merged into larger spaces, and so on, till extremely large cavities are formed, the whole system of branching being still a closed system. From a study of the models, it would appear that a group of normal branchings, such as are represented in the diagram, would, when merged, form only a very few emphysematous air-spaces. The remains of alveolar walls, projecting into such spaces, would be accounted for in this way.

As to the actual origin of emphysema, various theories may be mentioned. In chronic bronchitis, the air which is drawn in by the expansion of the thorax, must enter the lungs at ordinary air-pressure. Just previous to the expulsion of air by the cough, when the glottis is closed, the air-pressure in the lung is increased. Thus the capillaries in the alveolar walls are subject to increased pressure with each cough, for the thorax being compressed by voluntary muscular effort, the alveoli are prevented from expanding farther, and are crowded against one another. In time this intermittent pressure may, by reducing blood-supply, bring about atrophy of the alveolar walls. It is possible that the capillaries which are most peripheral will be affected first. This would account for the trouble beginning in the terminal parts of the bronchiole, and progressing proximalwards.

It might be argued that the intermittent pressure and the extra stretching of elastic fibres, would damage the elastic fibres directly, though Osler states that the capillary net-work disappears before the walls are completely atrophied.

Again, it has been suggested that the longitudinal stretching of the capillaries intermittently, to an extreme degree, reduces their usefulness, since if the diameter of a capillary in this stretching process is reduced, for example, by ½, then only ¼ of the normal amount of blood will pass through the capillary.

In Osler and McCrae's "Practice of Medicine", the statement is made that "heightened pressure within the air-cells may be due to forcible inspiration or expiration". As to the increasing of pressure by forcible expiration, an example has been given in the case of the cough of chronic bronchitis, and other examples are found in such occupations as glass-blowing and the playing of wind-instruments. In forcible or in ordinary inspiration, the air in the lungs remains at the pressure of the outside air, but as soon as the glottis is closed, the elastic tissue and perhaps the involuntary muscles of the walls of air-passages come into action, and would bring about some degree of collapse of the lungs, if this tendency were not counteracted by the voluntary muscles in "holding the breath". Whether air-pressure in the lung can be increased during actual inspiration may be questioned, since the thorax in expanding increases in volume by the volume of the air that enters the lungs.

We find that keen observers such as Virchow and Osler strongly suspect that emphysema is of congenital origin. This might apply to any part of the respiratory system, *e.g.*, the elastic fibres, the involuntary muscles, the complicated nervous mechanism, or even the walls of the thorax.

We know that in the embryo the lung begins as an out-pouching from the oesophagus, and that by a gradual process of budding and branching, the complicated bronchial tree is built up. The whole object of these out-pouchings and branchings is to provide a large area of that lining of "respiratory epithelium" through which oxygen is taken up into the blood. It has been shown that in the normal lung, each cubic millimetre of respiratory lung tissue corresponds to 14 square millimetres of this lining epithelium, and that in a moderate case of emphysema, because the air-spaces are larger, the corresponding area is about 7 sq. mm., so that the emphysematous patient may have only half his normal amount of respiratory epithelium.

The statements made in this article have for the most part been based on the examination of sections under the microscope, and on the work of wax-reconstruction. In formulating theories to account for structural differences in normal and emphysematous lung, we are on less firm ground, and are dealing with a problem involving very many factors. The writer does not claim to have solved this problem, but has submitted a few suggestions, believing that at any rate they will lead to interesting discussion.

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BREECH PRESENTATION

W. G. Cosbie
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About three per cent. of children present by the breech. It is not an accidental presentation but arises from some abnormality, of the uterus, the pelvis, or the foetus, which prevents the normal adaptation of the foetal to the maternal ovoid. Resultant from it is an infant mortality three times that associated with normal vertex presentation. Therefore, it must be considered as one of the most important forms of dystocia.

Breech presentation is more frequently found with premature children and then is of no particular importance. Occasionally in such cases, however, there may be some difficulty in delivering the aftercoming head, because the more premature the child the larger the head is relatively to the body, and the cervix which allows the body to pass through may restrain the head.

When breech presentation occurs at full term in a primipara it suggests disproportion between the size of the child and the maternal pelvis, if not actual contraction of the latter. The lax abdominal wall of mutiparity predisposes to breech presentation, as also do hydramnios, twins and placenta praevia.

There is great value in the early recognition of breech presentation, because if it is recognized before the thirty-sixth week of pregnancy an external version will generally be successful in converting the presentation into a cephalic one.

On abdominal examination the determining feature of diagnosis between breech and vertex is the location of the firm round head. Ballottement of the head aids in substantiation. Also when the breech presents there is rarely engagement of this soft broad part. Auscultation of the foetal heart sounds above the umbilicus is also suggestive.

Very little can be made out by vaginal examination before the onset of labour as the presenting part is nearly beyond reach. Once the breech has begun to descend into the pelvis, however, it is readily recognizable. It has been confused with the face, and a large caput such as forms in prolonged labour with a posterior occipital presentation may to a degree similate it. Yet the distinctive features of the breech are unmistakable, namely, the bony tubercles of the ischia, with the crease of the buttocks passing backward to the rough surface of the sacrum and the tip of the coccyx. Occasionally a finger may be passed into the anus, the consequent discharge of meconium and the manner in which the anal sphincter grips the finger will distinguish it from the mouth. In such cases as those in which the feet or a foot is palpated, the heel and the lack of mobility of the great toe are the points of distinction from the hand, for which it might otherwise be mistaken.

The course of labour when the breech presents is prolonged, except in the case of a premature child. In common with other malpresentations not infrequently the onset of labour is marked by the rupture of the membranes with the discharge of considerable liquor amnii. This, coupled with the fact that the breech is a poor dilator of the cervix,

predisposes to a prolonged first stage. Should solid meconium come away when the membranes rupture the diagnosis of breech is almost certainly substantiated.

If the full breech presents cervical dilatation is slow but sufficient to allow the aftercoming head to pass through the cervical ring. But in the case of a footling, difficulty may arise because of the difference in size between the two poles of the child. Should the legs be extended, that is a frank breech presentation, the progress of the child through the pelvis is slow and sometimes impossible, because of splinting of the body by the femora interfering with lateral flexion of the trunk, by which mechanism the body passes through the curved pelvic axis.

It is rare, indeed, for the patient of her own unaided powers to give birth to her child, unless in a case of prematurity or a multipara with a small child. From the umbilicus on Art must aid Nature.

As a rule the breech presents with the sacrum pointing to one or other lateral front. The engagement, therefore, of the presenting part is with the bi-trochanteric diameter in one or other oblique diameter of the maternal pelvis. As the breech descends into the pelvis the anterior buttock touches the pelvic floor first and rotates to the front, behind the pubes. Then by a process of lateral body flexion the child bends itself around the pubes, and as a result of the expulsive efforts of the patient, the posterior buttock sweeps over the perineum and is born. The anterior buttock being no longer tightly held under the pubes slides out readily. The child's body follows, and by the time the tip of the scapula appears, the shoulders are in the pelvis, being in the antero-posterior diameter. Normally the arms lie flexed on the chest and provide no delay. The anterior shoulder hooks behind the pubes, whilst the posterior shoulder sweeps over the perineum to be born. The anterior shoulder follows by sliding down from behind the pubes. The head now engages, and as it rotates to bring the occiput to the front external rotation of the body is noted. The head is born by flexion, the nape of the neck hooking around the back of the pubes. The chin, face, and brow sweeps in turn over the perineum.

The management of a breech presentation may call for all our ingenuity and skill. Whereas in a multipara, with a history of previous easy labours, the foetal and maternal risks are trifling; on the other hand in a primipara at term, the condition is one of major importance. So grave indeed is the risk to the child that in an elderly primipara caesarean section is definitely indicated. In all cases occurring in primiparae the pelvic measurements should be carefully checked over, to be certain that there is not a contraction of the pelvis.

The guiding principle in treatment is watchful waiting, and when assistance is required, to aid the maintenance of universal flexion, and apply force from above, rather than traction from below.

During the first stage the patient is best kept in bed in order to preserve the bag of fore-waters. Should the membranes rupture prematurely an examination is made, to see that prolapse of the cord has not occurred. As prolonged first stage is not unusual, some analgesic or hypnotic may be indicated, such as—rectal ether, morphine scopolamine,

heroin, or chloral and bromides given per rectum. Should the cervix seem unduly resistant a hydrostatic bag may be used to hasten dilatation.

The difficulties which arise in the course of labour, granting there is not absolute disproportion, are due to extension of the legs, arms or head.

If the breech is arrested at the brim of the pelvis it is practically always due to disproportion, or else there is something blocking the entrance to the pelvic cavity, *e.g.*, tumour or placenta. The most usual is that the child is of considerable size and the pelvis is slightly contracted.

When it is decided that delivery must be through the natural passages the proper procedure is to bring down a leg, preferably the anterior, and if the cervix is fully dilated, traction is made. It is unwise to pull on the leg, if the cervix is not dilated, as this will cause the arms and head to become extended.

Should the progress of the breech cease in the pelvic cavity, the commonest cause is that the legs are extended. It is not a bad plan to examine when the cervix is fully dilated, to determine whether or not the legs are extended, because it is easier to flex the legs the higher the breech is in the pelvis. It is often extremely difficult, and sometimes impossible, when impaction of the breech has occurred. The method to be followed is to pass the hand up along the anterior leg to the knee, bend the knee by pushing it outward, and when the ankle may be grasped the foot is brought down. Pressure on the abdomen will aid in bringing the ankle within reach. Failure to bring down the foot necessitates traction being extended with the finger in the groin. If this is unavailing a fillet may be passed over the groin as a tractor, or as a very last resort a blunt hook may have to be used.

In the vast majority of cases the patient of her own efforts brings the breech down onto the perineum which after a time stretches to allow the breech to pass over it. The attendant aids by guiding the breech forward toward the pubes, and may at his discretion hook the feet out to hasten progress. In a primipara it is a good practice to do an episiotomy when the perineum is distended, as this will not only hasten delivery, but relieves the vaginal walls from overstretching, and will allow greater freedom when an attempt is made to deliver the arms and head.

The child's body will be born to the umbilicus with the next two or three pains, and then pressure on the fundus will aid in bringing the costal margin in sight. To pull down a loop of cord, and observe its pulsation, will give warning of any need to hurry.

As a rule the arms are delivered by grasping the feet of the child in the left hand, slightly flexing the body toward the mother's abdomen, sliding the right hand up the latero-posterior aspect of the chest to hook the fingers in the fold of the elbow of the posterior arm, and so sweep it down and out. The anterior arm is either delivered as an anterior arm, by depressing the body and hooking the arm out from behind the pubes. Or else the body may be rotated to bring the arm posterior when it is delivered as described previously.

When the arms are extended there is difficulty in their delivery. It is more liable to happen when the body of the child is grasped closely

by the pelvis as it passes through, typically this is seen in a relatively small pelvis. Again, when the cervix is not fully dilated, as, for example, when an incomplete breech has presented, the arms are apt to be held back when the trunk descends. But most important of all to realize is that when delivery is hastened by traction from below, the arms almost invariably will become extended.

The method of delivery is the same as described before, except that one must reach further into the vagina to grasp the upper arm, follow it upward to the elbow, flex this between the fore and middle fingers, and then sweep the forearm over the face and chest of the child, and so out.

A rare complication is due to displacement of the forearm to the back of the neck, the so-called nuchal clutch. This is generally the result of traction with torsion of the trunk in an effort at delivery. Rotation of the child's body to make the child face the displaced arm will bring the arm to the ventral aspect of the child.

Lastly, we come to consider the delivery of the head. The underlying principle of all methods is to maintain or cause flexion. The Smellie-Viet method is most generally used. The child's body lies astride the arm. Two fingers of the hand are inserted into the child's mouth, well back toward the base of the tongue. Smellie originally applied these fingers over the malar eminences, but the risk of dislocating the jaw is slight unless vigorous traction is made. The fingers of the other hand are placed over the child's shoulders from the back to exert traction. This shoulder traction was the feature of the Viet method. The head is pulled down, and when the occiput catches behind the symphysis, the child's body is slowly raised forward to keep the line of traction always in the axis of the pelvis. Finally, as the head sweeps over the perineum, the body is held almost upright. Supra pubic pressure by an assistant is always of considerable help.

Arrest of the head at the brim is due to disparity between the head and the pelvis, or else extension of the head has occurred. This most often is due to incomplete dilatation of the cervix, or premature effort at traction. If flexion of the head with traction on the shoulders fails, the best thing to do is to apply forceps. Care must be taken that a rim of cervix is not caught by them at this time.

Rarely the occiput rotates into the hollow of the sacrum. If this should occur, the head and trunk are firmly held by the Smellie-Viet method, and rotated so as to bring the occiput to the front. If this fails the best method to follow is an adaptation of the so-called Prague method, namely, to grasp the child by the ankles with one hand and over the shoulders, from behind, with the fingers of the other hand. The body is then carried well back, and then up, toward the mother's abdomen. Suprapubic pressure is applied by an assistant. Once again, however, forceps may be the method of choice.

There is no doubt that a difficult breech extraction properly carried out is a technical triumph, comparable to any brilliant surgical operation. Every step is the result of the thought and practice of the masters of obstetrics throughout the ages. It is to a degree the epitome of obstetrical art.

ASPECTS OF PHYSIOLOGICAL HYGIENE

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In the organization of the new School of Hygiene of the University of Toronto provision has been made for the more intensive investigation and teaching of physiological principles which are applicable to preventive medicine. A very large part of the activities of the teaching sections of public health organizations has consisted in the study of communicable diseases and of the methods of prevention of epidemics. It is established, however, that the scope of preventive medicine can profitably be extended to include a discussion of those conditions which maintain the organs of the body at their maximum efficiency and of the adaptations of the body to its environment. The application of certain physiological principles to preventive medicine has already been made and it is felt that instruction in these will help to prepare the students of public health for their work, particularly in the school and industrial aspects of preventive medicine. The attempt to apply the results of new physiological experiments to the prevention of disease is certain to be highly interesting.

The selection of subjects for consideration in a course in Physiological Hygiene is facilitated by the knowledge of what has been found appropriate in the schools where a department with a similar objective has been established (Johns Hopkins and Harvard Universities). The facilities available, the preference for subjects which have a Canadian application, and to a lesser extent the special research interests of those who conduct the course also exert an influence upon its construction.

A course in hygiene usually begins with an enumeration of the principal causes of death. It then proceeds to discuss these various factors from a public health point of view—a view which, quite rightly, is deeply stained with the bacteriological. It would appear that the proper place for Physiological Hygiene in a course in preventive medicine is at the beginning. Instruction in the methods of maintaining health naturally precedes the study of the specific factors which produce or favour the spread of disease.

It is generally agreed that considerable emphasis can properly be placed upon this aspect of preventive medicine, which may be called Physiological Hygiene. Its object is to provide instruction in and to investigate those factors which are responsible for the maintenance of the normal physiological standards of bodily function. The extent to which we have departed from these standards was vividly demonstrated by the results of physical examinations during the war. In one very large series of men examined in England only one-third were found to be fit for full active service. Twenty per cent. were suitable for certain types of service. Approximately a third were not fit for any such

exertion as was necessary in the army. The remaining ten per cent. were not fit for any service whatever. Great efforts were made to find some standard of physical fitness on the basis of which to classify men. There are obvious difficulties in arriving at such a standard. Measurement of the vital capacity and determining the relation of this value to surface area, body weight, and the size of the chest, was thought to give a good indication of the degree of fitness and standards have been set upon this basis. It is manifestly impossible to gauge the fitness of the body as a whole by determining a value which may run parallel with the efficiency of a limited part. A complete physical examination, including a study of the response of the various organs to their work and the recovery from this is the only way to assay fitness. The results of periodic physical examination of apparently healthy people are demonstrating the frequency of quite unsuspected abnormalities, many of which may be eliminated by early treatment. These examinations might be considered a practical application of Physiological Hygiene, utilizing, of course, the principles of physical examination as developed in clinical medicine. The number of people who are periodically examined is rapidly increasing. Physicians are practically unanimously in favour of the procedure. Certain universities have made provision for the periodic examinations of their students. It is not sufficient to require a preliminary examination. It is inconsistent to advise medical students that periodic examinations are one of the most important aspects of preventive medicine and not to make provision for the examination of the students themselves at intervals throughout their course.

These facts are discussed in detail, at the beginning of their course, with the students of public health. To enable them to appreciate better some of the ways in which physiology can be applied to preventive medicine a review of certain physiological principles has been found necessary. Certain aspects of the physiology of respiration, circulation, metabolism of food, and muscular exercise, are discussed, and demonstrations to illustrate salient points are arranged.

The adequate control of our environmental conditions, provision for proper ventilation, illumination, and ultraviolet radiations are of the utmost importance in keeping the body free from disease. Equally significant are the questions of an adequate, balanced diet, muscular exercise, physical training and fatigue.

It is still necessary to emphasize the fact that bad ventilation is not attributable to accumulation of carbon dioxide or deficiency of oxygen. The ill effects are usually produced by the diminished cooling power of the air, and this condition is due to excessive temperature or humidity or to diminished air movement, or a combination of these factors. One of the practical exercises is the determination of air movement by the katathermometer, a large alcohol thermometer graduated at 100 and 95° C. This instrument is also used to measure cooling power of the air. Relative humidity is determined by calculation from the wet and dry bulb thermometer readings. Cooling power as determined by the dry or wet bulb katathermometer has been correlated with the sensation of comfort, by Hill, Vernon and others. By the use of the katathermometer

ventilating conditions can be adjusted so that the recommended degree of cooling power is secured. Workers in the United States believe that a value termed "effective temperature", which is determined from the temperature, relative humidity, and air movement, is a better indication of comfort. Certain combinations of these values give an "effective temperature" within limits called the "comfort zone". There is conflict of opinion at the present moment between the English and American workers as to whether the katathermometer or "effective temperature" readings are the more reliable indication of comfort. Bulmer, in a recent investigation in Ontario, has found that a katathermometer cooling power recommended by the English group usually gives an "effective temperature" within the "comfort zone" of the American investigators. It is well to remember that the sensation of comfort may be quite differently interpreted in the different countries. The methods which have been developed to measure the efficiency of ventilation serve very well to enable sudden changes to be eliminated or to detect gross deviations from the accepted values. The principles of ventilation are discussed with the students of public health and, as a part of the practical course, they make katathermometer and "effective temperature" determinations under various conditions.

The subject of illumination holds interest particularly for public health workers in schools or factories. Illuminating engineers recommend values for a variety of situations. There is considerable latitude in the number of foot candles required for "adequate" illumination, and, of course, individuals vary a great deal in their requirements. The elimination of shadows and the prevention of glare are important requisites for proper lighting. The students receive several lectures on the physiological and public health aspects of this subject and, as a practical exercise, chart the illumination of various rooms and become familiar with the principle and operation of the Macbeth Illuminator, a very satisfactory instrument for assaying illumination, and with a simple and inexpensive foot candle meter.

The study of ultraviolet radiations has a definite place in Physiological Hygiene because of their well proven effectiveness in the prevention of rickets. These radiations can be secured in Toronto, in adequate amounts for the prevention of rickets in animals from the sun during the Spring, Summer and Autumn as Tisdall and Brown have shown. In December, January and February the amount available is apparently much less. The use of glass which is much more permeable to these short wave-lengths than ordinary window glass should be advantageous in circumstances where individuals are not able to be out of doors, and during the months when these radiations are available in adequate amounts. There is some evidence that the penetrability of these glasses to ultraviolet radiations decreases fairly rapidly with age. The stimulating and beneficial effects of cool, moving air are lacking in "sun baths" from artificial sources of ultraviolet radiations, but the effects may nevertheless be of great value in the prevention of certain conditions. The recent work of Mrs. Mellanby on the effect of the antirachitic factor, which can be supplied in cod liver oil or by ultraviolet radiations, on

tooth formation in young animals and children is one of the greatest contributions to preventive dentistry. There have been numerous reports of the rise in resistance to infection produced by exposure to ultraviolet radiations, but convincing evidence of this effect is yet unavailable. There is no increase in any of the specific antibodies of the blood of animals on exposure. An increase in the bacteriocidal power of the blood has been reported from Leonard Hill's laboratory, and recently Edinow has stated that this increase takes place at the site of irradiation. Confirmation of these results would give us a probable explanation of the reported increased resistance to infection. The discovery that inert materials can be endowed with antirachitic properties by irradiation with ultraviolet rays has aroused great interest. Attention was focused on cholesterol for a time, but now ergosterol is hailed as the "mother substance" of vitamine D. Irradiated ergosterol is a very potent antirachitic substance. Instruction in this phase of physiological hygiene is largely by lectures, but sources of artificial ultraviolet radiations, the carbon arc and mercury vapour lamps, are investigated and the use of several of the methods recommended for the assay of these radiations is demonstrated.

The subjects of diet and nutrition are discussed in a series of lectures given by the Professor of Biochemistry. As one of the practical exercises in Physiological Hygiene the students carry out a determination of the basal metabolism of one of their number by the Douglas bag procedure. The subjects of muscular exercise, physical training, and fatigue are considered in some detail. An attempt is made to point out the application of the results of physiological experiments on isolated muscles to the problems of muscular exercise in man. The food material used by the isolated muscle during contraction can be studied by chemical analysis of the muscle tissue and by other methods. Carbohydrate is the chief, if not the only, material used. In the intact organism the food used during muscular exercise can be determined by analysis of the air expired during the exercise and recovery periods. In the whole organism the energy for muscular exercise is also largely provided by carbohydrate. When carbohydrate is used in the isolated muscle lactic acid is formed. If there is an abundance of oxygen available there is no accumulation of lactic acid. If the supply of oxygen is deficient the acid accumulates, neutralized by the protein and alkaline salts of the muscle, until a concentration is reached in which the muscle is unable to contract. In the same way lactic acid is formed during muscular exercise in man. It diffuses away from the actively contracting muscles and the concentration in the blood may become greatly increased. It has been calculated that the lactic acid concentration in human muscles, when a subject is completely exhausted, is approximately the same as the lactic acid maximum of isolated frog's muscle. Both the isolated muscle and the intact organism can go in debt for oxygen. The magnitude of the oxygen debt is directly proportional to the amount of lactic acid which has accumulated. The amount of oxygen necessary to oxidize the accumulated acid is the measure of the oxygen debt. The oxygen debt in a human subject is determined by measuring the amount

of oxygen used from the moment the exercise is stopped until the oxygen consumption has returned to the resting value. From this figure the resting oxygen consumption calculated for this same period of time is subtracted. The resulting value is the oxygen debt incurred during the exercise. Subjects recover at different rates from a given oxygen debt and a study of the rates of recovery in a large series of apparently normal individuals, as A. V. Hill has suggested, would be of great interest. Meakins and Long have recently reported some interesting studies on the oxygen debt in circulatory failure.

We know very little about the exact changes which take place in the muscles during training. An increased glycogen content has been reported. An enhanced buffering power which would increase the lactic acid maximum has been suggested. The muscle fibres increase in size. It is likely that the blood supply is increased. The changes in the physiological responses of the heart and lungs as a result of training have been fairly extensively studied. The oxygen carrying power of the blood is increased. The basal metabolism is said to increase slightly during training. As a subject becomes better trained for any particular exercise many superfluous movements are eliminated. It is possible that there is better relaxation of the muscles whose action is opposed to that of those involved in the exercise. Certainly the subject works more efficiently. The oxygen required for a given piece of work is reduced. The available data on these points are discussed and practical exercises illustrating certain points are arranged for the students.

Several extensions of the course are being developed and others are contemplated. A room is being equipped with a heating system, humidifiers and fans so that any combination of atmospheric conditions can be secured. The students will be used as subjects in certain type experiments or demonstrations in ventilation. Metabolism under various conditions will be studied by other procedures in addition to the Douglas bag method. Feeding experiments, conducted by the students on experimental animals, to illustrate certain aspects of nutrition, are contemplated.

Lectures and demonstrations in the course in Physiological Hygiene occupy about fifty hours. Thirty hours are devoted to practical work.

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THE UNIVERSITY OF TORONTO PRESS

THE TERCENTENARY OF HARVEY'S DISCOVERY OF THE CIRCULATION

J. J. R. Macleod

This year marks the tercentenary of the publication of Harvey's immortal book, "On the motion of the heart and blood in animals", and the event is being celebrated in various centres of medical learning. The publication of this book marked the beginning of the modern epoch of physiological and medical science. Vesalius had thrown doubt on the Galenic doctrine, that blood passes through invisible pores in the septum of the heart from right to left ventricle, so insistent was he on proof for all he described that he did not venture to assail established beliefs without the evidence which a searching of nature could reveal. Some of Vesalius' followers, especially Columbus and Fabricius had gone a step farther than he, with regard to certain aspects of the movements of the blood, the former forecasting the pulmonary pathway and the latter admirably describing the valves of the veins, but the old Galenic belief, that the blood ebbed and flowed along the arteries and veins to and from the heart, still held men's minds when Harvey wrote. Every great discovery in science is built on foundations laid by previous discoveries and there can be little doubt that Harvey found the foundation for his great discovery in the work of his Paduan teacher, Fabricius, but beyond this he built unaided.

Harvey's book is a sustained argument from beginning to end. In the Latin in which it was originally written it is said that in some parts the meaning is obscure but in the admirable translation into English by Willis, and especially in the revised edition of this translation by Bowie, every sentence is clear as a bell, and I know of no volume in medical science, ancient or modern, in which theoretical reasoning is more aptly supported by anatomical and experimental evidence. The book, and it only consists of less than a hundred small pages, could with profit be made a required text for every student of Medicine.

In order to give an idea of the chaotic state of knowledge of the circulation when Harvey wrote, let me quote from the introduction: "Almost all anatomists, physicians, and philosophers, up to the present time have supposed with Galen that the object of the pulse was the same as that of respiration, and only differed in one particular, this being conceived to depend on the animal, the respiration on the vital faculty; the two in all other respects, whether with reference to purpose or to motion, comporting themselves alike". Then follows a general questioning of the orthodox views and opinions, ending up with the conclusion "that what has heretofore been said concerning the motion and function of the heart and arteries must appear obscure, inconsistent or even impossible to him who carefully considers the entire subject". The motions of the heart first receive attention but the task was "so truly arduous" that Harvey "was almost tempted to think . . . that the motion of the heart was only to be comprehended by God". But he did not give

up. He found a solution of the problem by transferring his attention from the beating heart in mammals to that in cold blooded animals, toads, frogs, serpents and the like. In these he could follow the sequence of events, auricular beat preceding ventricular, and as a result of the latter a discharge of blood into the large arteries so that "the heart, by squeezing out the blood it contains becomes paler and then when it sinks into repose and the ventricle is filled anew with blood, . . . the deeper colour returns".

Next he considers the motions of the arteries, the pulses, and after citing a number of simple experiments concludes "in opposition to commonly received opinions that the diastole of the arteries corresponds with the time of the heart's systole; and that the arteries are filled and distended by the blood being forced into them by the contraction of the ventricles". This is all so plain to us now that we can scarcely realize the importance of these words in the history of physiology. But before the old doctrine of an ebb and flow of blood could be finally overthrown it had yet to be shown how a unidirectional flow from veins to arteries is provided for and this is explained in the fourth and fifth chapters. They are perhaps the most interesting of all, although of less general importance than the eighth chapter. They supply the proof, anatomical and experimental, for the conclusion:

"First of all, the auricle contracts, and in the course of its contraction forces the blood, (which it contains in ample quantity as the head of the veins, the store-house and cistern of the blood,) into the ventricle, which being filled, the heart raises itself straightway, makes all its fibres tense, contracts the ventricles, and performs a beat, by which beat it immediately sends the blood supplied to it by the auricle into the arteries. The right ventricle sends its charge into the lungs by the vessel which is called vena arteriosa, but which, in structure and function and all other respects, is an artery. The left ventricle sends its charge into the aorta, and through this by the arteries to the body at large."

We have already pointed out that several of his immediate predecessors had to a certain limited extent anticipated Harvey in the discovery of the circulation of blood through the lungs, but none of them had proved it, and most anatomists still believed with Galen in the existence of invisible pores in the septum of the heart. Indeed, so firmly had this belief become established that for some time after Harvey's clear demonstration of the pulmonary circulation a movement of blood or at least of "spirits" was supposed to occur across the septum. Van Helmont in his great work "Ortus Medicinae", published in 1648, held such views, and, indeed, they were not finally abandoned until Franciscus Sylvius, the famous professor of medicine at Leyden, from 1658 to 1672, championed them.

Another pre-Harvian notion which seems strange to us to-day was that the pulmonary artery, or the artery-like vein, as it was called, served merely as a pathway for the ebb and flow of crude blood between the right ventricle to the lungs and the pulmonary veins (vein-like artery), for the transmission of blood which might, on the one hand carry air from the lungs into the left ventricle to cool down and temper the fire of life which it was supposed burned here, and on the other hand, carry to the

lungs the fuliginous vapours which it engendered. To this fire, burning continuously from birth to death, was attributed not only the heat of the body—one function of the blood being to distribute this heat to the peripheral parts—but also the engendering of "vital spirits" which made the blood of the left ventricle and arteries redder (more arterial) than the crude blood of the right ventricle and veins.

In order to break down these theories Harvey had first of all to demonstrate beyond all doubt that the blood passes between the two sides of the heart by no other pathway than through the lungs. Therefore, he points out, there is only one ventricle in animals having no lungs, such as fishes and in frogs, turtles, etc.,—which have lungs only "in a certain sense", primitive lungs, we would say—there is also only one ventricle. In the embryo of man also the position of the foramen ovale and its membranous valve shows that blood passes freely from vena cava to left ventricle because the lungs are not required, which also accounts for the ductus arteriosus. Harvey puts it in this way:

"In embryos, consequently, whilst the lungs are yet in a state of inaction, performing no function, subject to no motion any more than if they had not been present, nature uses the two ventricles of the heart as if they formed but one, for the transmission of the blood. The condition of the embryos of those animals which have lungs, whilst these organs are yet in abeyance and not employed, is the same as that of those animals which have no lungs."

But strong though this comparative physiological evidence might be, a great difficulty was to explain how blood could actually circulate through the lungs. Such a conception was an entirely new one and to most men, untenable. Harvey had to show by analogy that very large quantities of fluid may, under certain conditions, percolate through various other organs of the body besides the lungs. After large potations, he points out, the extra fluid passes out of the body in an hour or so by the urine and hence must pass through the liver and kidneys which, however, are very much denser structures than the spongy lungs. Moreover, the lungs must expand and contract with each respiration and, like a sponge compressed and released, soak up and expel the blood. And then, finally, he points out that the valves of the pulmonary artery are so disposed as to compel an unidirectional flow by this vessel, and not an ebb and flow. The whole argument is summed up by Harvey in the following words:

"It therefore appears that, although one ventricle of the heart, the left to wit, would suffice for the distribution of the blood over the body, and its education from the vena cava, as indeed is done in those creatures that have no lungs, nature, nevertheless, when she ordained that the same blood should also percolate the lungs, saw herself obliged to add the right ventricle, the pulse of which should force the blood from the vena cava through the lungs into the cavity of the left ventricle. In this way, it may be said that the right ventricle is made for the sake of the lungs, and for the transmission of the blood through them, not for their nutrition."

In the justly famous eighth chapter Harvey shows how the mass of evidence compelled him to conclude that "there might be a motion, as it were, in a circle" for the blood from the left ventricles to the great veins.

"The blood forced by the action of the left ventricle into the arteries was distributed to the body at large and its several parts in the same manner as it is sent through the lungs impelled by the right ventricle into the pulmonary artery."

He then set himself three propositions requiring proof if his general theory of the circulation was to hold: (1) "The blood is incessantly transmitted by the action of the heart from the vena cava to the arteries in such quantity that it cannot be supplied from the ingesta"; (2) "The blood . . . is impelled . . . in a continuous stream through every part and member of the body." (3) "The veins in like manner return this blood incessantly to the heart". To resolve the first proposition he considered the quantity of the blood which the heart must pump into the arteries in half an hour, assuming for this purpose the very lowest possible volume of discharge with each systole. He had found by measurement that the ventricle holds 2 ounces, but he assumed that only one drachm is discharged. The calculations show that more than all the blood in the body would pass through the heart in half an hour—would not Harvey have been surprised to know that this occurs in about a minute so that it could not possibly be derived from the ingesta. In connection with the first proposition he also points to the draining of all the blood from the body, by opening a small artery or vein, and to the relative emptiness of the arteries in a dead animal. Always practical, he discusses the cause of fainting in the light of these conclusions.

The second proposition finds easiest solution in a consideration of the effects of ligatures or fillets, as used in blood letting. This was an experiment performed daily by the barber surgeons and yet without any clear understanding of why the ligature had to be adjusted at a certain tension to enable free bleeding to occur. The use of such experiments to prove that the blood must pass through invisible porosities in the flesh from artery to vein was a bold stroke and one that must have won more converts to his views than any other.

The remaining proposition, the centripetal flow of blood in the veins was also attacked by experiments on the venous blood flow, and the simple experiments, so admirably described and illustrated in the thirteenth chapter, should certainly be performed by every student of Medicine.

When we remember that Harvey had no direct evidence that capillaries exist—for Malphigi and Leeuenhoek had not written—it is truly to be considered as one of the greatest achievements of scientific method that he should so absolutely have predicted that there are porosities, as he calls them, through which the blood passes from the arteries into the veins. It was only by incessant observation and vivisection of many animals, with constant study of the work of others and with thoughtful contemplation of all he had learned that Harvey gained for himself the undisputed title of the father of modern physiology.

SOME REMARKS CONCERNING NEURO-SURGICAL CASES

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Forty years ago Sir Victor Horsley in collaboration with Sir William Gowers, localized and removed a spinal cord tumour. Also about this time papers began to appear by Horsley, Macewen, Godlee, Keen and others, which pointed out that in certain cases at least, brain tumours might be dealt with by surgical means. In 1890 Rose (co-author of the well-known text-book of surgery, Rose and Carless), was the first to give a patient permanent relief from that terrible malady Tic Douloureux. All this is not so many years ago and despite the pessimistic viewpoint of many, advances in this field of surgery have progressed with a fair measure of rapidity. As in other surgical problems, this success has depended upon a reasonably early and correct diagnosis followed by scrupulous technical care. The management of an occasional neuro-surgical case is likely to be disheartening and it is only when a number of cases are concentrated that sufficiently good results are seen to make the problem worthwhile.

The purpose of these remarks will be to review some of the signs and symptoms of these cases in a manner which may be useful to the physician and at the same time point out the prognosis following appropriate surgical treatment.

BRAIN TUMOURS

Tumours of the brain occur far more frequently than is usually supposed. Post-mortem statistics show that brain tumours are found in from 1 to 2 per cent. of all complete autopsies. The symptoms and signs of brain tumour fall into two groups: A. Symptoms and signs due to increased intra-cranial pressure, B. Interference with the normal function of the brain.

A. Those due to increased intra-cranial pressure:

1. Choked optic discs.
2. Headache.
3. Vomiting.

A knowledge of the circulation of the cerebro-spinal fluid is essential in dealing with any of the problems associated with intra-cranial pressure.

The cerebro-spinal fluid is largely formed in the lateral ventricles, from there it escapes by the foramina of Munroe to the third ventricle. It then passes down the aqueduct of Sylvius to the fourth ventricle and from there passes up over the brain in the sub-arachnoid space to be absorbed through the arachnoid villi, largely into the longitudinal and lateral venous sinuses.

With the circulation of the cerebro-spinal fluid in mind, it is obvious that lesions 4 and 5 in Diagram 1, are so placed that the cerebro-spinal fluid would be dammed back into the ventricles before the tumour had

reached any great size. This damming back of the cerebro-spinal fluid is the common explanation of increased intra-cranial pressure. Lesions such as 1, 2, and 3 are not in a situation where they will dam back the cerebro-spinal fluid, unless they become very large. Tumours in this situation cause an increasing pressure in two ways: A. Because of the large size which the tumour may attain. B. Because of oedema produced in the brain adjacent to the tumour.

Increased intra-cranial pressure then may be produced in three ways, and whatever the mechanism it is transmitted to the sub-arachnoid space which surrounds the brain, spinal cord, and optic nerves.

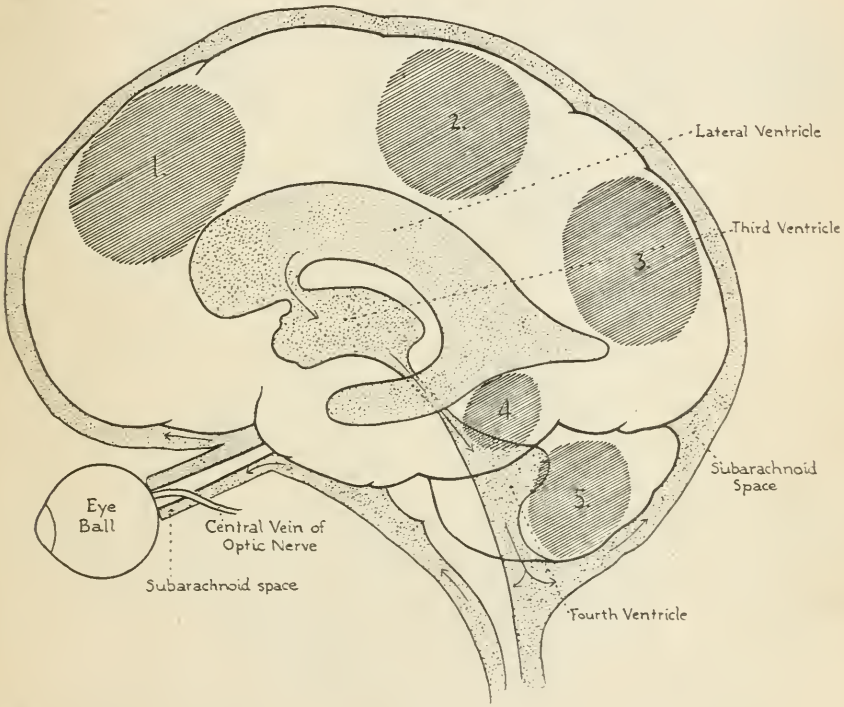

Diagram 1

Because of the markedly increased pressure about the optic nerve, the central vein of the nerve is compressed and the venous blood is dammed back causing the disc or end of the optic nerve to swell. This swelling or choking of the optic nerve can be seen with the electric ophthalmoscope and is the one reliable sign of increased intra-cranial pressure, as the other two signs, headache and vomiting, are often absent or not sufficiently marked to attract attention.

B. Signs and symptoms due to interference with the normal function of the brain.

The signs and symptoms falling under this heading will be briefly outlined with the help of the two following diagrams:

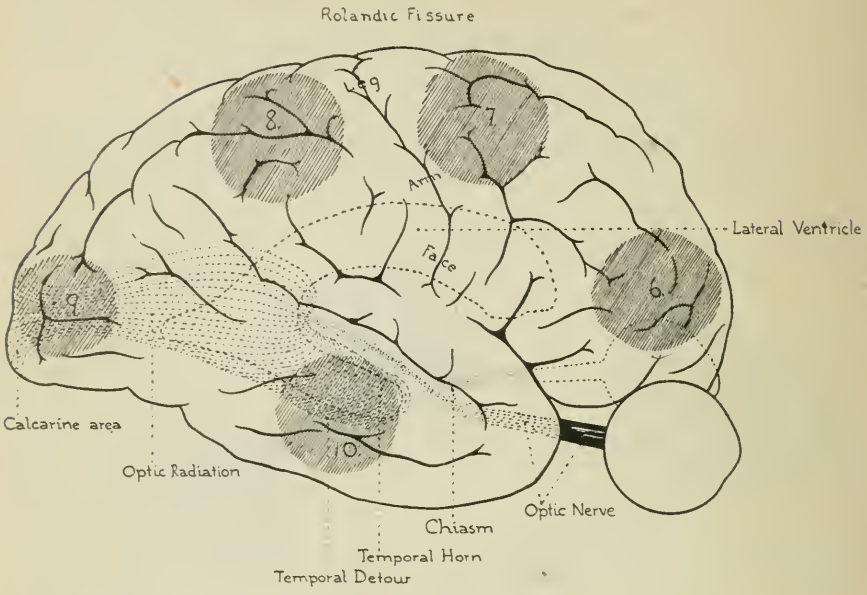

Diagram 2

Lesions 7 and 8. (See diagram ii).

Because of the involvement of the Rolandic area the outstanding signs will be weakness and sensory disturbance on the opposite side of the body and possibly Jacksonian seizures. Signs of increased intracranial pressure usually develop some time after the other signs and symptoms.

Lesions 9 and 10.

Because of the involvement of the optic radiation there will be a defect in the eye fields. The defect will be more marked in lesion 9 than in lesion 10 because the optic radiation is concentrated at this point. If the lesion is on the right side the field defect may be the only sign. Lesions in this situation in the left hemisphere are detected much earlier because of interference with speech.

Lesion 6.

This lesion is seldom diagnosed until signs of increased pressure develop. If the tumour is on the right side mild character changes may be expected; if on the left there is usually a more severe mental upset.

Lesion 11. (See diagram iii.)

This is a common site for the slow growing meningioma to develop. Both olfactory nerves are involved early and there will be complete loss of smell. Eyesight is seriously interfered with because of direct pressure on the optic nerves. Signs of increased pressure develop late.

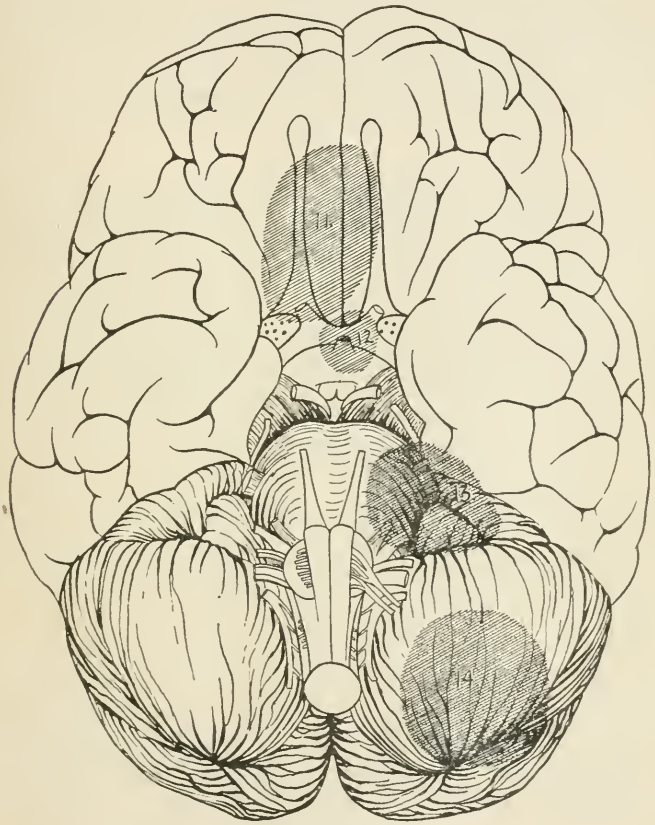

Diagram 3

Lesion 12.

Patients with lesions of the pituitary body come under observation because of interference with eyesight from direct pressure on the optic nerves. In a young individual there will be interference with growth and sexual development; in older individuals cessation of menstrual periods or loss of sexual power. The X-ray examination will likely show a large sella turcica.

Lesion 14.

Unsteadiness of gait, nystagmus, and fairly early and marked signs of increased intra-cranial pressure will be outstanding features.

Lesion 13.

A tumour in this situation is usually an acoustic neuroma which is slow growing and arises in close association with the eighth nerve. The history may extend over a long period of years. The first symptom will be buzzing in one ear, followed by nerve deafness; later there will be numbness of the face from involvement of the adjacent fifth nerve, and finally the signs of increased intra-cranial pressure and inco-ordination as in lesion 14.

The only indication of a tumour may be interference with the normal function of the brain, although it is true that almost always signs of increased pressure develop at some stage. The patient with a long history of disturbance of some part of the brain or of one of the cranial nerves is the one most likely to receive lasting benefit from surgical treatment. In a recent case in which a tumour was successfully removed, there had been convulsions and gradually increasing weakness in the leg and arm for seven years before signs of increased intra-cranial pressure developed. Again it is emphasized that for years the only indication of a tumour may be interference with the normal function of the brain or cranial nerves without the signs of increased pressure—such as the gradual onset of weakness in the limbs, failing vision, unilateral nerve deafness, difficulty with speech, convulsions (general or localized), etc.

X-ray studies of the skull either with or without the injection of air into the ventricles play a big part in localization, but this aspect of the diagnosis will not be discussed in detail here.

DIFFERENTIAL DIAGNOSIS.

Vascular Lesions.

Interference with the normal function of the brain is commonly due to a thrombosis of one of the cerebral vessels. When symptoms occur in an individual with marked evidence of cardio-vascular disease, and the absence of signs of increased intra-cranial pressure, it is unlikely that a tumour is present.

Luetic Lesions.

Basilar luetic meningitis which brings about a damming back of the cerebro-spinal fluid and often involvement of one or more cranial nerves, is common. Often there are no localizing signs, and the patients come complaining of headache and vomiting; in such cases choked discs will be present. The Wassermann will be positive, and appropriate treatment will result in rapid improvement. If improvement is not rapid the possibility of a tumour even in the presence of a positive Wassermann should be considered. Patients having brain tumours have been treated for syphilis until they became blind.

Multiple Sclerosis.

The unsteadiness of gait and nystagmus may suggest the possibility of a cerebellar tumour, but the long history with absence of the signs of increased intra-cranial pressure will establish the correct diagnosis.

Lethargic Encephalitis.

Stupor with signs of cranial nerve involvement, headache and vomiting may be associated with either brain tumour or encephalitis. However, the onset in encephalitis is usually abrupt and associated with some fever. The discs are normal, whereas with a brain tumour in stupor the discs are almost always choked.

PROGNOSIS.

Without operation the outlook is hopeless. Often preceding death there is a prolonged period of blindness, paralysis and headache. In the majority of cases it is not possible to remove the tumour. A decompression operation may save vision and relieve headache in these patients and the procedure is not dangerous. In a smaller group of cases the tumour can be removed and a permanent cure effected without damage to the brain. In this group the mortality is higher, but the technical difficulties are gradually being overcome and more complete removals are being carried out in cases that in the past have been considered hopeless.

Brain Abscess.

The diagnosis of a brain abscess is made on the two groups of symptoms and signs which occur in brain tumours plus the presence of a focus of infection and the constitutional signs of suppuration.

The primary foci of infection associated with brain abscess are in the order of their occurrence: 1, middle ear suppuration; 2, frontal sinus infection; 3, compound fractures of the skull; 4, lung abscess; 5, general blood stream infection from a boil, septic throat, or such a disease as scarlet fever.

Often the first symptom is a convulsion, usually followed by a period of several days of severe headache, high fever, restlessness and chills, due to a localized meningitis and encephalitis. The patient may recover completely from this, or be overwhelmed and die from meningitis. If a brain abscess develops it is likely preceded by a quiescent period of several weeks and then the signs and symptoms of interference with function and increased intra-cranial pressure manifest themselves. At this stage the patient is apathetic, pale and obviously sick. If the primary focus is not giving rise to a constitutional reaction the temperature will not be high, usually ranging from 97 to 100. The pulse, which is fast at first, becomes slow (50 to 70) as intra-cranial pressure develops. The leucocyte count ranges from normal to 15,000—if a lumbar puncture is done the fluid may be normal or show a fairly high cell count. A lumbar puncture must, however, be undertaken with a great deal of caution as the sudden releasing of pressure below may convert a localized meningitis into a general one. There is a specimen illustrating this catastrophe in the

University of Toronto Museum. Personally I prefer not to do a lumbar puncture on a brain abscess suspect.

The picture just sketched is the typical one. The onset in the atypical case may be very insidious and if the abscess becomes well walled off in a comparatively silent area of the brain, the signs and symptoms may escape notice. It is possible for a patient to go through life with such an abscess; usually, however, it finally ruptures into the ventricle or subarachnoid space and death from meningitis rapidly ensues.

PROGNOSIS AND TREATMENT.

Without operation the outlook is practically hopeless. The diagnosis and technical treatment are difficult, but these are cases well worth fighting for. In ten cases treated during the past three years, three are dead, five are well and working, two are still in hospital. A patient with a brain abscess probably has a little better than a fifty per cent. chance of being returned to his or her former occupation.

CRANIO-CEREBRAL INJURIES.

Head injuries are now becoming so common that it behooves all of us to have a fairly satisfactory working knowledge of these cases.

When an individual receives an injury to the head it is well to be cautious regarding the prognosis. Even though the patient appears normal, haemorrhage from the middle meningeal artery may be occurring and the patient will become dull in a few hours, and unconscious shortly afterwards. Or a patient with a severe laceration of the brain may seem well for forty-eight hours and then die in the next twelve. Several months after an injury all the symptoms of a brain tumour may appear as the result of a venous haemorrhage on the surface of the brain, or later still the liquefied and encysted blood clot may cause epilepsy, mental deterioration, headache, etc. Most often, of course, the individual who appears normal shortly after an injury remains well.

When a patient is seen shortly after injury and is unconscious, a certain routine is followed.

Shock is treated by stimulants, warmth and bandaging the legs, and above all, the patient is placed on his side so that the breathing is not obstructed by the tongue. The blood pressure may remain low, the pulse and respirations fast and death supervene in a few hours. If the patient's condition improves it is then time to deal with a compound fracture if present, by removing all loose pieces of bone, any protruding brain and making an accurate approximation of the scalp with two layers of interrupted sutures which will control haemorrhage. If a small drain is left in, it should only be for a few hours to carry off any haemorrhage which may not be thoroughly controlled. If a depressed fracture is present it may be dealt with any time within a few days.

Compression and Medullary Failure.

A careful check is kept on the patient's blood pressure and respirations. Loud blowing respirations gradually dropping to eight or six a

minute with a rising blood-pressure and increasing unconsciousness indicate compression of the brain. And if this compression cannot be overcome, the medullary centres soon show signs of failure by a rising pulse, fast respirations and a falling blood-pressure and always death.

When a patient is seen showing signs of compression, think always of extra-dural haemorrhage from the middle meningeal artery—if there has been a lucid interval of several hours after the injury, this is almost certainly the diagnosis—and the case must be dealt with surgically within a few hours.

If the compression is not due to an extra-dural haemorrhage, the intra-cranial pressure is lessened by judicious spinal punctures and hypertonic intravenous solutions, and above all, by having no obstruction to the breathing. This can be accomplished by having the patient on his side, the tongue pulled forward and a couple of good sized rubber tubes keeping the nostrils open.

PROGNOSIS.

The outlook is excellent in depressed fractures, fair in compound fractures, depending on the extent of the injury to the brain and infection which may cause meningitis or brain abscess.

In middle meningeal haemorrhage the prognosis is excellent if dealt with before there are signs of failure of the medullary centres. In compression of the brain due to oedema and often associated with severe lacerations, the outlook is extremely doubtful, although recovery is frequently brought about.

When there are signs of failure of the medullary centres (fast pulse, falling blood pressure, fast respirations), death is almost a certainty.

Tic Douloureux (*Trigeminal Neuralgia*).

The fifth nerve through its three divisions is the sensory supply to the face—the first division supplies the eyeball and forehead region—the second division the upper jaw region—the third division the lower jaw and anterior two thirds of the tongue.

Any one or all of these divisions may be involved in Tic Douloureux. The diagnosis is made on the history and by seeing the patient during a spasm of pain. The onset occurs in two ways: A. A sudden severe stab of pain lasting a few moments and making such an impression that the patient remembers all the circumstances vividly for years afterwards. B. The first attacks of pain may be mild and gradually work up over a period of months to the typical severe spasms.

Any one spasm lasts from a few seconds to a minute or two—relief is then complete—other spasms may follow at such close intervals that the patient is completely incapacitated for several weeks. A period of complete relief then follows lasting for weeks or months. The periods of relief, however, keep getting shorter and spontaneous cure cannot be hoped for.

The story is typical and the malady should not be confused with any of the inflammatory lesions in the sinuses or teeth which give a continuous type of pain. Despite the ease with which the diagnosis is made many

patients have been advised to have all their teeth extracted, tonsils out and sinuses explored, all perfectly futile procedures even if they are diseased, as far as curing Tic Douloureux is concerned.

PROGNOSIS AND TREATMENT.

There are only two treatments worthy of consideration at the present time:

1. Alcohol injection.
2. Section of the sensory root between the Gasserian ganglion and the brain.

Alcohol injection can be used when either the second or third divisions are involved, but not for the first division, and relief may be expected for a period of months or even several years, but sooner or later the patient is likely to demand the permanent relief that can be promised with so much certainty by operation. The danger of operation is not great. During the past three years forty-nine cases have been operated on; one unfortunate man died from meningitis. The remaining forty-eight cases are most grateful patients. Many of them were over seventy years of age when operated upon.

COURSES FOR GRADUATES IN MEDICINE

The Faculty of Medicine of the University of Toronto recognizes that the practitioners of the Province are anxious to keep closely in touch with the advances in Medicine, and that they have a claim on the Provincial University to aid them in doing so. The Faculty considers this entails on it a duty second only to the instruction of the undergraduate.

At the present time the large amount of undergraduate teaching makes it impossible to offer during the academic session set courses of sufficient variety to meet all the needs of those who seek further study.

Those who have studied abroad know that the routine method is for the graduate to attend the instruction given to the students of the senior years in Medicine, to follow the ward rounds and to go to the out-patient department picking up what he can. The Faculty has opened the courses of instruction given to the higher years in Medicine to any one who cares to attend and refresh his knowledge in this way. A Standing Committee has been appointed whose duty it is to give any graduate interested, advice as to the clinics and lectures which should be taken and to confer with the heads of departments and individual teachers so as to arrange a course in advance for each applicant. Such a course may be modified by the committee if it does not prove suitable.

During each year graduates attend undergraduate courses of this kind.

All the library facilities of the University will be open to any post-graduate student under the usual conditions.

The staff fully realizes that every effort must be made to render the visit of each post-graduate student both pleasant and of real value. Instruction may be obtained as outlined above in the following:

Medicine.
Surgery.
Obstetrics and Gynaecology.
Paediatrics.
Otology, Rhinology, Laryngology.
Ophthalmology.
Preventive Medicine.
Pathology and Bacteriology.

The University will impose a minimum fee of $25.00 per month. This will be imposed for any course of less than a month as a registration fee. Graduates attending courses will be charged a supply fee to cover the cost of materials or equipment supplied.

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THE UNIVERSITY OF TORONTO PRESS

DEGREE OF DOCTOR OF MEDICINE (M.D.)

The authorities of the University of Toronto have revised the degrees in Medicine so that students upon graduation in the future shall receive the degree of Doctor of Medicine (M.D.), instead of Bachelor of Medicine (M.B.).

This amendment in the regulations has been made retroactive, so that every graduate in Medicine of the University of Toronto who now holds the degree of Bachelor of Medicine is entitled on application to be admitted without examination to the degree of Doctor of Medicine (M.D.) on the payment of a fee of Ten Dollars ($10.00).

Any graduate desirous of admission to the degree of Doctor of Medicine (M.D.) should forward his or her application with the fee of Ten Dollars, to the *Registrar of the University*, giving name in full, home address and year of graduation.

Graduates who have been admitted to the degree of Doctor of Medicine (M.D.) for post-graduate work are authorized to add the designation *cum laude* to the degree of M.D.

PHYSIO-THERAPY OR TREATMENT BY PHYSICAL AGENTS

G. E. RICHARDS,

Associate in Radiology, University of Toronto

Physio-Therapy may be defined as that branch of therapeutics in which the active principles are certain physical agents as distinct from chemicals or drugs. The term, therefore, includes within its scope all the varieties, both new and old, of light (photo-therapy); electricity (electro-therapy); various waters and baths (hydro-therapy); massage; remedial gymnastics; and finally, if we are to be consistent, the several varieties of "rays" or radiation therapy such as ultra-violet, X-rays and radium.

Unfortunately several of these have been, in the past, exploited by charlatans outside the profession, or by some within who were over-enthusiastic or unreliable in the claims made of results obtained until it became difficult to convince the conservative members of the profession that this whole branch of therapeutics was not, in fact, beyond the pale, or at best of very doubtful value.

Unfortunate also is the fact that most of the literature now being distributed on this subject is the propaganda of selling organizations, many of whom will sell their apparatus equally readily to a graduate in medicine or to the latest product of the chiropractic college. The comedy of this situation might be passed off as being simply ridiculous until it is realized that with such equipment and a new diploma these men are then free to treat anything from acute lobar pneumonia to infantile paralysis, and that detailed instructions for the treatment of each may be obtained with the delivery of the machine supplemented by a free demonstration by the salesman.

Thus there is a danger that the medical profession may be placed in a position in which it is made to appear that no other form of treatment is used except drugs or medicines, whereas, of course, the truth is that practically all of these methods were developed by members of the medical profession. It should be our aim to ensure that those which possess merit are fully accepted and freely adopted, while if some of these methods are not of value every physician should be fully aware of the fact and should know the reason why.

The following observations have been prepared by request in an attempt to answer a part at least of this question. Any merit they may possess lies in the fact that they represent personal observations in a large number of cases during the past ten years, and have not been copied for the purpose from any text-book.

In attempting the study of a subject of this kind it will greatly simplify the problem if we resolve into a few fundamental principles the various agencies to be discussed. When this has been done it will be seen that in several of these we are face to face with old friends whose actions and indications are at once apparent when they have been shorn of their mystery. In a few others we have improved or more con-

venient means of applying methods of treatment long in use. In a few instances only are we actually dealing with a "new" addition to our general Therapeutic armamentarium.

They fall naturally into certain groups.

I. *LIGHT*

In the first group will be considered various applications of *Light*. On first glance this might appear to include only visible light, but in view of our present knowledge it goes much further. It should not be necessary in these days of radio and the general knowledge of wave-lengths to emphasize the fact that visible light is merely a part (and a very small part) of the immensely greater Solar spectrum, and that the only difference between the colour we call red and the colour we call violet is wave-length. These wave-lengths are so short that whereas radio waves may be stated in terms of hundreds of meters in length from crest to crest, when we come down to visible light, the length of the waves must be stated in millionths of a centimetre. A special unit of measurement had to be devised for this purpose, and this, named after its proposer, is called one "Angstrom" and is equal to 1-100,000,000 of a centimeter. Using this scale visible light ranges from Red-7700 Angstrom units down to Violet 4040 Angstrom units.

This conception of light leads directly to the much greater one of the whole range of radiations or "rays". We appreciate as visible light those waves, or radiations, falling between 7700A and 4040A, because the human retina is sensitive to this wave-length, but extending out from both extremes of these, which we can see, are others which cannot be seen, but have important physiological properties none-the-less. On the one side, just beyond the red end of the spectrum, are the infra-red rays, chiefly sedative in character and producing heat, but having few chemical properties, just as the colour red is chemically inactive as compared with violet. On the other end, beyond the violet, are the so-called ultra-violet rays, intensely active chemically, strongly bactericidal and powerfully stimulating to metabolic processes generally. Far beyond these again come the X-rays, and finally the gamma rays of radium. And, in a general way, it may be said that the only fundamental difference between any of these agents is the difference in wave-length peculiar to each. It is essential to keep this constantly in mind, since it is usual to think of all of these as being radically different agencies, whereas, strictly speaking, the use of any of them as a therapeutic measure is merely the use of differing forms of the same physical agent, *i.e.*, a different form of "radiations".

II. *ELECTRICITY*

In the *Second Group* we would consider the various forms of Electricity. From the very first discovery of Electricity means were sought to utilize it in the treatment of disease, and unfortunately from that time down to the present, there have been those who have made impossible claims some of which rival the claims of the greatest fakes of medical history.

In industry the successful use of electricity has depended entirely upon a thorough understanding of the fundamental laws of electricity and their application, and, if it is to be used equally well in medical work, the same course must be followed.

The physiological effects of electricity have now been studied for a sufficient length of time to permit us to set down at least the more important of the effects which may be secured, somewhat as follows:

(1) Electricity causes the contraction of healthy muscle (both smooth and striped) under suitable conditions.

(2) Electricity causes the ionization of solutions both within and without the living cell.

(3) The resistance offered by the body to the passage of certain types of currents results in the production of heat, and this may be produced at any chosen point and to any desired degree.

(4) Applied upon the surface of the body in suitable form electricity may produce counter-irritation in any desired degree.

There are admittedly other functions and applications of electricity, and yet we believe these four sum up the more important effects, and, apart from them, no physiological results occur which have thus far *been demonstrated.*

III. *HYDROTHERAPY*

In the *Third Group* we would place Hydrotherapy, *i.e.*, the use of water in all its forms and under a great variety of modifications as applied to the human body.

Here, also, the diverse effects can probably be summed up in a few familiar phrases:

(1) Heat—moist heat—causing peripheral dilatation and being generally sedative to the Nervous System.

(2) Cold—causing contraction of the peripheral vessels and tonic in its effect.

(3) Counter-irritation—Combined with either of the preceding and used in the form of the various whirling baths, sprays, douches and aerated baths.

IV. *MASSAGE*

The *Fourth Group* includes massage, remedial gymnastics and re-educational exercise, etc.

Here are included a whole series of procedures of too complex a character to be touched upon in a brief paper such as the present.

Group 1

Ultra-Violet Radiation

Bearing in mind the place which they occupy in the spectrum we think of these rays merely as vibrations having wave-lengths roughly from 4000A down to 1860A. Normally present in the sunlight, and

responsible for much of its chemical effects, they are, however, easily obstructed and filtered out by clouds, smoke, etc. Hence they are chiefly present in the sunlight on high mountains.

Various artificial means are at our disposal for the production of ultra-violet rays, of which the most effective are exposed electric arcs between carbon points or mercury vapour arcs enclosed in fused quartz containers. The latter are, generally, more convenient to use but do not provide the best substitute for sunlight since the range of the rays produced is much shorter than any rays normally present in sunlight. Allowing for this, however, they are of very great value in a variety of ways, and, if combined with a carbon arc and some means of producing the longer waves, an excellent substitute for sunlight may be secured. Such a combination is of peculiar value in this latitude from October until May, when the available sunlight is uncertain and of a degree of intensity little suited to therapeutic requirements.

Physiological Effects of Ultra-Violet Rays

There are three essential effects of these rays upon the body, a knowledge of which would indicate clearly certain results which might be expected.

These are:

(1) Increase in the calcium content of the blood.

(2) Increase in the inorganic phosphorous content of the blood.

(3) Increase in the platelets.

These effects are more definite and uniform in young children than in adults, but also occur in the latter. In addition other effects have been shown to occur, including an increase in the red blood corpuscles, a rise in the lymphocyte count and in the haemoglobin.

Two types of apparatus are in use:

(1) The air-cooled lamp.

(2) The water-cooled lamp.

The air-cooled type has several trade names ("Alpine Lamp", etc.) as well as other incorrect names (such as Quartz Light), all of which are used to designate an apparatus the output of which is "ultra-violet radiation". This name should, we believe, be generally adopted, but should be strictly distinguished from another very similar misnomer, viz., "violet rays", with which it has nothing whatever in common.

Air-cooled lamps may be either mercury-vapour or carbon-arcs.

They are used in a variety of ways and produce two main types of reaction, *viz.*:

(1) Local.

(2) General.

Local effects are also produced by the small water-cooled apparatus, and include relief of pain in such conditions as neuralgia, neuritis, sciatica and in certain forms of arthritis.

The *general effects* are of the greatest value and within rather well-defined limits, we believe, are of more importance than has yet been fully realized.

(1) *Rickets*

The effects of ultra-violet rays in this disease may be regarded as a specific therapy, and so much has been written that it is unnecessary to take further time here.

(2) *Adenopathy*

Simple enlargement of cervical and mediastinal glands in children form a field in which these rays are of the greatest possible value. The typical case is one in which following repeated infections the mediastinal glands are enlarged, causing an irritable, unproductive cough. This in turn is associated with loss of weight and appetite and the clinical picture so familiar to all. There is usually a suspicion at least of an early tuberculous process. Such cases frequently respond in a manner little short of the spectacular, and there need be no hesitation in using this treatment in any such type of case.

(3) *Tuberculosis*

Tuberculous adenopathies are benefited by ultra-violet rays, but the results are slow and treatment must be continued patiently. Combined with X-ray treatments good results may be expected in a high percentage of the cases. The average duration of such treatment will be six months to a year.

Tuberculous peritonitis and cystitis respond well in a fairly uniform manner, and both are suitable types of cases for treatment, combined, of course, with the other usual methods.

Surgical tuberculosis, *i.e.*, of bones and joints, is far too large a subject to discuss here. Many institutions have reported beneficial results and now use this method routinely as an adjunct to surgery and other methods. It is agreed that no artificial source is as beneficial as natural sunlight when this is available.

Tuberculosis of the skin, including Lupus. Since most of the early work on ultra-violet ray therapy was done in this group more information is available and nearly all of this is favourable. Cures may be expected in from 50% to 75% of the cases treated if the treatment is thoroughly carried out under proper technical conditions.

IV. *TETANY*

Most observers agree that the results of ultra-violet ray therapy in tetany are almost as specific as in rickets and certainly are definite enough to justify its use in any such case.

V. *SKIN DISEASES*

In skin diseases this method has been of less value in our experience than X-rays though there is no doubt of its value in a somewhat restricted field.

The same may be said of its use in certain chronic pulmonary infections, such as chronic bronchitis, some forms of bronchial asthma, etc.

VI. *THE ANAEMIAS*

Normal blood absorbs all rays with wave-lengths below 4500A, and it was therefore hoped that much benefit might be derived from this method in various forms of anaemia.

Our observation is that this is true of most of the simple anaemias. Here it can be shown that there is an increase in the number of red corpuscles with a corresponding improvement in the haemoglobin. The clinical improvement which results is frequently marked and the patients all feel the improvement. There is much experimental work to support this which we have not the time to consider. "Effects include engorgement or congestion of the vessels, accompanied by a rise in the lymphocyte count. The calcium content of the blood is increased, as is also the inorganic phosphorous, while at the same time intestinal organisms are reduced. Two minutes daily irradiation of a baby has been sufficient to double the inorganic phosphorous of its blood in a fortnight."

The increase in inorganic phosphorous and calcium are both exceedingly valuable and desirable effects which we have been trying for years to accomplish by the administration of drugs. These results are accompanied by others less easy to prove, but it is reasonably certain that the entire metabolism is stimulated and the resisting powers of the body to disease increased. Such changes would naturally be reflected in improvement in a variety of diseases as well as in the anaemias. While benefit is usually quite noticeable in the simple anaemias, however, the graver forms, such as pernicious anaemia and most of the severe secondary anaemias, have not been benefited in a manner which has made any material change in the course of this disease.

Since it is impossible in a short paper to do more than indicate general principles we may conclude this section by stating the opinion that the above include the major conditions in which ultra-violet rays may be counted upon for definite results. So long as it is not regarded as a panacea for all ills, and cases are selected falling within fairly definite limitations, much may be accomplished—beyond that there will be many disappointments and failures.

INFRA-RED RAYS

Following the grouping suggested at the beginning we should refer to these rays at this point as being at the other end of the visible spectrum. They also are invisible and their function is to carry heat. It has been shown experimentally that these rays carry or produce heat within the tissues, thus raising the temperature locally. So far as is known that is their sole property. They, therefore, are of value, like diathermy, in any disease or condition for the cure or relief of which heat is known to be of value. In our experience this method of treatment is about on a par with various forms of radiant heat or baking, but not

so useful as diathermy. It is of chief value in large areas, such as the chest or trunk, or some irregular portions of the body where diathermy cannot be applied so effectively. There are several small portable types of apparatus which are inexpensive and very useful for this purpose. They operate from any ordinary light socket and may be taken to the bedside and left there. Treatments last from half an hour up and may safely be repeated. The larger lamps cause a moderate fall in blood pressure (probably entirely due to peripheral dilatation), and if the patient's pressure is already low this may result in a feeling of depression following treatment. In one case this amounted to a degree of cerebral anaemia characterized by irrationality. Obviously in such cases the treatment should not be repeated.

X-RAYS, RADIUM, ETC.

While these were included at the beginning to complete the classification it is not intended to discuss them further at this time, merely pointing out that they, again, differ from each other and from ultra-violet and visible light merely in being an infinitely short wave-length but otherwise the same physical agent. (Reference, of course, only to gamma rays of Radium.)

ELECTRICITY

Of the various forms of electricity in use at the present time that which is known as Diathermy is probably the most popular.

This is a method of utilizing a high frequency current. The frequency is so high that the passage of this current through the body is not accompanied by pain or any unpleasant sensation. The tissues, however, offer considerable resistance, which results in the production of heat and this may range anywhere from gentle warmth to a degree sufficient to cause coagulation of the tissues, *i.e.*, they are literally cooked. Such a production of heat is accompanied by congestion of the vessels. The heat may be local and confined, *e.g.*, to one joint, or may be general, and in this way the temperature of the whole body may be raised several degrees.

Owing chiefly to the propaganda of manufacturers and a few over-enthusiastic writers, the impression has been spread abroad that diathermy is some wonderful new discovery which may be relied upon to cure anything from a humpback to a wooden leg. The facts are that it is not new and that it is merely another way of applying *heat*. It has the great advantage, however, that the heat is easily controlled and can be produced within the tissues almost at any chosen point.

The Indications

Any disease or injury for the relief or cure of which heat is known to be of value will be benefited by diathermy. A few of these are so outstanding as to deserve special mention.

(1) *Gonorrhoeal Epididymitis*

It will probably be admitted that this is a disease which has been difficult to treat in the past, and among the many methods tried have been included both heat and cold. The results of treatment by diathermy are quite as spectacular as the treatment of rickets by ultra-violet rays and occur much more promptly. This is so true and so uniformly successful as to justify the term "specific". In fact, there are few distressing diseases in which it is possible to secure such prompt and satisfactory results, and it undoubtedly is the method of first choice.

The same is true but in a more restricted sense of gonorrhoeal arthritis in the acute and sub-acute stages. In the chronic and late stage, when organic changes have occurred, results are very little better than by other methods. But in the early stages the results are excellent, and should certainly be sufficient to render this the method of choice, combined, of course, with other usual methods—immobilization, etc.

Results so uniform and outstanding suggest a special underlying reason, and this is found in the comparatively low lethal point of the gonococcus when killed by heat. This is said to be less than 50° C. (*i.e.*, about 110-115° F.), and it is easily possible to raise the temperature of the joint or other tissues affected to this temperature and maintain it there as long as necessary. This would seem to account for the effects secured.

(2) *High Blood Pressure*

The statement is repeatedly made that diathermy will reduce high blood pressure. It is, of course, true that this effect occurs in a certain number of cases, but it has been our experience that the reduction is not very permanent and by no means uniform. Some years ago we tried out this method in a series of cases, keeping careful blood pressure charts before and after the treatments. During these treatments the body temperature is elevated and the patients break out into a profuse sweat —that is to say, there is a rather marked dilatation of all the peripheral vessels. We came to the conclusion that any reduction of pressure which occurred was due to this peripheral dilatation, and although the actual reduction might be considerable, it did not last more than a few hours, twelve being about the maximum. Apart from the peripheral dilatation we doubt if there is any other effect in this respect and, therefore, the method is no better than any one of several other methods available for blood pressure reduction.

(3) *Pneumonia*

About three years ago Dr. Harry Eaton Stewart published his results in the treatment of pneumonia and has since published a book upon this subject. He states that if lobar pneumonia is treated by diathermy *within the first* 48 *hours* the death-rate will be very materially reduced. Two years ago, with the permission of Prof. Graham, we tried out this method. A machine of ample capacity was placed in the ward and a trained attendant assigned to the duty of carrying out the treatments.

The method and technique described by Dr. Stewart were followed carefully, and during the winter each alternate pneumonia patient received this treatment in addition to the usual routine, while the other alternate patients did not receive diathermy. At the end of the period our group of cases had one death more to record than those who had not received diathermy.

The only conclusion we felt justified in drawing from this work was that diathermy did not materially affect the death-rate of lobar pneumonia in the type of case met with in the Public Wards of a General Hospital. The reason is probably found in the fact that the average day of admission of these patients was the *fifth day of the disease.* The patients, therefore, were very seriously ill and some were almost moribund.

A few felt benefit from the treatment in the sense of added comfort, relief of dyspnoea, etc., but in others we concluded that this was more than offset by the inconvenience and consequent fatigue of arranging the electrodes and giving the rather prolonged treatment.

But since Dr. Stewart specifically states that the treatment must be given during the first 48 hours, and since in our cases it was not possible to start treatment until the fifth day, we do not feel in a position to make any statement on the merits of the method other than the above. This will have to come from those who have an opportunity of using it in the early stage of the disease.

Neuritis

We have not been able to verify the claims made for diathermy in the treatment of neuritis, and on theoretical grounds there is little reason to expect much relief from the pain in this disease. Diathermy treatment is almost invariably accompanied by congestion and swelling and to add this to the already swollen nerve sheath is frequently only to increase the pain.

I venture the opinion that the cases treated in which relief has been claimed in neuritis have not been true cases of neuritis, but have been some form of bursitis or more likely myositis.

The latter group, together with *sprains*, *muscle lacerations* and *recent fractures*, form a group in which some of the best results may be obtained which are possible by any form of therapy.

Take the typical case of a sprained ankle or wrist, even in the presence of a minor fissure fracture. Such cases also include most muscle lacerations such as occur on the football field and in industrial injuries. There is pain, swelling, a haematoma of greater or less extent, and laceration of muscle or ligament.

The success of treatment depends upon its early commencement following the injury. But if it be commenced promptly and given thoroughly once or twice a day the results are exceedingly satisfactory. The pain is frequently relieved at once and disappears often during the treatment or within an hour or less after it is completed. The swelling rapidly subsides and function is restored much sooner than otherwise.

Case Report of a Later Stage

Patient had his middle finger struck by a baseball with the usual painful swelling of the mid-phalangeal joint. This continued nearly a week without improvement, the treatment consisting of fixation with a splint, hot compresses, fomentations, and the usual lotions, etc. At the end of the week it was no better, and at this time diathermy was started. Half an hour after the first application the pain ceased and did not return. In forty-eight hours the finger was normal in size and very soon after was fully restored to normal function.

This result could have been obtained equally well immediately after the injury, and thus have saved the patient a week of considerable discomfort. It illustrates a whole group of cases, including many industrial injuries in which the greatest possible benefit may be obtained.

There is also a series of fractures in which similar results are possible, and, I believe, but have not had an opportunity to prove the accuracy of this opinion, that we could almost revolutionize the treatment of some types of fracture if diathermy were used immediately. This includes all the minor linear cracks and fractures near joints in which there is no risk of displacing the fragments by the necessary manipulation. The pain is relieved, the swelling goes down rapidly, and the muscles remain soft and active.

The Arthritides

There is perhaps no problem facing us which offers greater difficulty than the problem of arthritis in its various forms. To group them all together is so inaccurate as to be indefensible, and yet time does not permit any other method of dealing with them in this paper.

If one might attempt a general statement it would be to say that the best results have been seen in cases of sub-acute arthritis or synovitis of the non-tuberculous groups. Gonorrhoeal arthritis has been referred to and the results in suitable cases of this form are not equalled in any other. In the chronic forms with permanent joint changes, such as old osteo-arthritis, little can be accomplished.

In all forms in which benefit is obtained it is chiefly in relief of pain and swelling. In the sub-acute types this is frequently enough to be regarded as a cure. In others again it is merely a palliative application which is justified through the comfort given the patient. If we remember the statement made at the beginning of this section, *viz.*, that, after all, diathermy is merely the most effective method in our possession of applying heat to the interior of a joint, then its usefulness and indications will be fairly evident without further elaboration.

In the deforming types of arthritis, such as arthritis deformans, we have seen no real benefit, nor can I see how it could be expected.

Surgical Diathermy

If one of the electrodes used in diathermy is large and the other a point, or nearly so, then all the heat is generated around the smaller electrode. This heat is intense and rapidly causes coagulation of the

tissues, thus providing an excellent means of destroying various types of growths both superficial and within several of the cavities of the body.

To discuss this use of diathermy adequately would require a whole paper in itself as there are several large books upon the subject. Here again, however, the method is far from new. It has been in use in England for many years, and the famous French surgeon Doyen devoted most of one volume of his great system to it, believing at the time he had solved the problem of the cure of cancer.

In skilful hands it is a great boon to certain surgical procedures, but, like every instrument of its kind, its real usefulness depends entirely upon the skill with which it is employed. At the present time its use in the removal of tonsils is having a great boom in certain quarters, and, while it is true that the tonsil can be effectively destroyed by this means, it is also true that it is a decidedly second-best procedure to a well-done surgical removal; that it frequently leaves tags of tonsil tissue which are later very difficult to remove; and finally it is decidedly not devoid of danger as everyone knows who has seen a few haemorrhages following its use.

Diathermy is experiencing a period of popularity which may react unfavourably upon the profession unless its uses and limitations are more carefully respected. I recently received a very nasty lecture from a patient when I declined to continue diathermy treatments which had been given elsewhere for the replacement of a floating kidney. How any such result could be expected by anyone who understands the agent he is using is too subtle a point to catch, and the use of this agent in such cases is too close to the methods of the charlatan for the medical profession to countenance.

OTHER FORMS OF ELECTRICITY

Galvanism

This is merely the continuous direct current and either the positive or the negative pole may be used as the active electrode.

The galvanic current is transmitted by both nerve and muscle, and is used in making the usual electrical tests of muscular reaction and to determine the integrity of nerve paths.

As a therapeutic agent it has been employed for the administration of so-called "Ionic Medication". By this means solutions are broken up and may be carried into the cells of the body by ionization. Many experiments are possible to prove that this actually does occur. In the treatment of gout a patient was treated with a solution of lithium. It was possible to demonstrate the presence of lithium in the urine, thus proving that it had been introduced into the patient's body.

A number of other drugs and chemicals can be used in a similar manner, but of these iodine or the iodides are those which have proved to have the chief clinical application. In cases of bursitis and arthritis there is very decided benefit from this method of treatment. It is not an easy method to adapt to office practice and a mistake in the technic

may result in a nasty galvanic burn. We feel the procedure should only be used by a thoroughly trained operator.

Galvanism, when interrupted, causes the well-known contraction of muscle, and this fact is made extensive use of in procuring forced contractions or electrical exercises of muscle. A great variety of applications of this principle are possible, depending upon the frequency and the suddenness of the interruptions and how long the contraction is sustained.

Thus we have the following:

(1) *Interrupted Galvanism*

Here the contraction is a sudden, short, sharp jerk and, if the current is strong, it may be painful. Since few muscles normally contract in this manner it is not frequently used.

(2) *Sinusoidal Galvanism*

A true sinusoidal current is one which was designed to imitate the slow contraction of smooth muscle fibre. The intensity of the current slowly rises to a maximum in a positive phase, as slowly dies away to zero, and the whole sequence is then repeated in a negative phase. Such a contraction provides for a period of powerful tonic contraction and a period of rest, and is of very great value in forcing the contractions of muscles whose function is diminished, such as occurs after industrial accidents. This is the current which is used to stimulate the contraction of the smooth muscle of the colon in constipation. For this treatment the current is further modified and administered in a form which is known as a surging sinusoidal current. With the electrodes suitably arranged the abdominal muscles undergo a powerful writhing contraction, and there is also a contraction of the muscle of the colon which can be so powerful as to cause a painful intestinal cramp. Such treatments carried out over a period of time undoubtedly assist in restoring the tone of the intestinal muscles as well as those of the abdominal wall with resulting benefit in cases of constipation. But the treatments must be continued over rather long periods, few cases showing much improvement in a short time.

A good deal has been written regarding the use of this type of treatment for the relief of adhesions. As to the real value of such a procedure it is obviously difficult to reach an accurate opinion. In a short series of cases so treated there were several in whom the symptoms disappeared or were greatly diminished, and the patients were convinced they had received benefit, but none were operated upon so that no opportunity has presented itself to prove what has taken place in respect to the adhesions, nor have X-ray studies been of any material help in this particular group.

In summing up one's impressions upon so broad a subject one conclusion seems to stand out sufficiently as to deserve emphasis, *viz.*, in each of the various methods described there are certain fairly definite

results to be expected, which are determined by the nature and properties of the agency employed and the biological or chemical response on the part of the body to this agency. If cases are carefully selected for treatment because of these two known factors great benefit may be expected with quite as much uniformity as in any other form of therapy—in some instances with more.

In addition there are certain other borderline groups in which one or other of these factors is absent or unknown, and in such cases, while treatment may be quite justifiable, the results will be much less definite.

Beyond these two main groups lie a whole multiplicity of diseases in which there is no possibility whatever of any benefit being derived. To blindly continue the haphazard use of such methods for the "mental effect" or for any other reason will only tend to bring the method into disrepute, and thereby delay the normal progress of a system of therapeutics having much inherent value and the possibility of considerable further improvement.

NOTES ON THE PHYSICS OF RESPIRATION

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A discussion of the physical forces that regulate respiration and the relations to each other of the various contents of the thoracic cavity is always interesting.

Normally the pressure in the chest outside of the respiratory tract is negative, or, in other words, is less than that of the atmosphere. During respiration this pressure always remains negative except on forced expiration against resistance when it may for the moment become positive.

This negative pressure is due to the elasticity of the lungs, and when this elasticity is lessened, as it is in emphysema of the lungs, the pull on the surrounding structures becomes less and may entirely disappear and as a result the thoracic cage expands.

Ever since the newly-born child took its first inspiration the lungs are constantly on the stretch. In the foetus the lungs are collapsed and empty of air, but when the infant is born it takes a breath, and as the chest expands by muscular action the air rushes in and the lungs are ballooned out. As Macleod puts it: "The thorax does not expand on inspiration because air rushes in, as the uninitiated imagine, but air rushes in because the thorax expands."

It is well to remember that during quiet respiration the expiratory act is chiefly passive and due to the elasticity of the lungs. These are stretched by the inspiratory muscles, and when these cease to act the lungs shrink and air is forced out. Also during inspiration the diaphragm contracts and descends and thus increases the vertical dimensions of the chest and at the same time raises the intra-abdominal pressure, and as soon as the diaphragm ceases to act this abdominal pressure pushes it up from below and it is pulled up by the elasticity of the stretched lungs and thus air is pressed out.

Quiet expiration is hence largely a passive act and occurs when the muscles of inspiration cease to act.

When the lung elasticity is lost from emphysema this passive help is lessened and expiration must depend upon muscular action, and this adds to the work of the respiratory act.

One constantly hears of the "cohesion" between the two layers of the pleural sac, but the term is an unfortunate one as the surfaces are in no way stuck together, but the visceral pleura is firmly pressed against the parietal one with a pressure equal to that of the atmosphere, less the pull of the stretched lung, which is about 4 to 10 mm. of mercury. In other words, the intrapleural pressure is some 4 to 10 mm. of mercury less than that of the general atmosphere.

The elasticity of the lungs explains the occurrence of pneumothorax. When either of the pleural layers is punctured and air can reach the potential pleural sac the lung subsides and the pleura fills with air. Granting that the opening into the cavity is sufficiently large the air pressure in and outside of the lung is now the same and the lung has

shrunk owing to its elasticity just as a distended toy balloon collapses when the mouthpiece is opened.

If the wound in the pleura be small the lung may not at first collapse as air has not been able to get between the closely applied layers, but at any moment this may occur and then the tendency of the lung to shrink asserts itself.

When pneumothorax occurs the side of the chest becomes larger because the normal pull of the stretched lung on the wall has been removed. For the same reason the mediastinum moves towards the sound side, being pulled over by the elastic drag of the other lung. In time, if the opening that has produced the pneumothorax be of a valvular nature, the pressure in the affected side may become positive, and then the enlargement of the side and the movement of the mediastinum with its contents towards the other side are due to positive pressure.

When the operation for the production of artificial pneumothorax is done a hollow needle connected with a manometer is introduced through an intercostal space, and when the needle is in the pleural sac the movement in the manometer is free with respiration, but not so if the point of the needle be in the tissues or in the lung.

The question arises: how can a needle enter a space which is only a potential one, the two layers being constantly pressed together by the atmospheric pressure? One theory is that the needle always punctures the lung and the first part of the pneumothorax is from air so entering. Whatever the explanation may be, however, the fact remains that it is easy to put a needle into the pleural sac and so introduce air into it from without.

In the many cases of gun-shot wounds of the chest, associated with haemothorax, that occurred during the War, it was soon noticed that the affected side was often smaller than the other. This was contrary to what one would expect, as certainly in pneumothorax and pleurisy with effusion the affected side is enlarged. It was specially observed that the side measured the least when the effusion of blood was small, and the explanation probably is, as was suggested by Sir John Rose Bradford, that the injured lung had *actively* collapsed, as it tends to do often in cases of operative traumatism in the region of the upper abdomen. Such collapse is not due to elasticity but to an active contraction of the musculature of the lung tissue. It usually only lasts for a short time, and later on the side will, if it contain much blood, measure more than the normal one.

The question of why bronchiectasis occurs has given rise to much discussion and the matter is by no means yet settled. Evidently the cause is not always the same, and certain forms are easily explained. Thus, when the condition occurs in the midst of a fibrosed lung it is evident that the shrinking of the newly-formed fibrous tissue has pulled on the bronchial wall and thus dilated it from without. Again, when a closed bronchus contains an increasing amount of secretion the bronchus must dilate as the internal pressure of its contents increases.

But bronchiectasis often occurs where there is no evidence of fibrosis of the surrounding lung and when there is no occlusion of the bronchial

lumen. What, then, is the cause? A common theory is that it is due to coughing, the pressure in the bronchus during the forcible expiration against resistance causing it to dilate. But a moment's consideration of the physics of coughing will show that this cannot be the reason. Coughing consists of three stages. First, the glottis closes, next the expiratory muscles contract and raise the pressure in the whole chest, and finally the glottis is thrown open and the imprisoned air rushes out, making the characteristic sound. Now, during the expiratory stage the pressure is not more raised inside than outside of the bronchus and the bronchus will not tend to dilate any more than it will tend to collapse.

A theory that is more in accord with physics is that the cause of bronchiectasis is inspiration rather than expiration. During inspiration, and especially forced inspiration, as usually occurs before a cough, all the tissues of the lung are put more or less on the stretch. When the inspiratory act is over they tend to resume their normal state, but if any of them are diseased and have hence lost some degree of their elasticity they will not so readily assume their former shape and will thus remain dilated, and here we seem to have the explanation of bronchiectasis. It presupposes primary disease of the bronchial walls, such as chronic bronchitis, which disease is the cause of the necessary loss of elasticity. Also it must be remembered that the disease probably reduces or removes the muscular tonus of the bronchial wall.

No amount of inspiratory effort will cause bronchiectasis when the bronchial wall possesses its usual elasticity, as the stretched wall will immediately resume its normal calibre.

COURSES FOR GRADUATES IN MEDICINE

The Faculty of Medicine of the University of Toronto recognizes that the practitioners of the Province are anxious to keep closely in touch with the advances in Medicine, and that they have a claim on the Provincial University to aid them in doing so. The Faculty considers this entails on it a duty second only to the instruction of the undergraduate.

At the present time the large amount of undergraduate teaching makes it impossible to offer during the academic session set courses of sufficient variety to meet all the needs of those who seek further study.

Those who have studied abroad know that the routine method is for the graduate to attend the instruction given to the students of the senior years in Medicine, to follow the ward rounds and to go to the out-patient department picking up what he can. The Faculty has opened the courses of instruction given to the higher years in Medicine to any one who cares to attend and refresh his knowledge in this way. A Standing Committee has been appointed whose duty it is to give any graduate interested advice as to the clinics and lectures which should be taken, and to confer with the heads of departments and individual teachers so as to arrange a course in advance for each applicant. Such a course may be modified by the committee if it does not prove suitable.

During each year graduates attend undergraduate courses of this kind.

All the library facilities of the University will be open to any post-graduate student under the usual conditions.

The staff fully realizes that every effort must be made to render the visit of each post-graduate student both pleasant and of real value. Instruction may be obtained as outlined above in the following:

Medicine.
Surgery.
Obstetrics and Gynaecology.
Paediatrics.
Otology, Rhinology, Laryngology.
Ophthalmology.
Preventive Medicine.
Pathology and Bacteriology.

The University will impose a minimum fee of $25.00 per month. This will be imposed for any course of less than a month as a registration fee. Graduates attending courses will be charged a supply fee to cover the cost of materials or equipment supplied.

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THE UNIVERSITY OF TORONTO PRESS

DEGREE OF DOCTOR OF MEDICINE (M.D.)

The authorities of the University of Toronto have revised the degrees in Medicine so that students upon graduation in the future shall receive the degree of Doctor of Medicine (M.D.), instead of Bachelor of Medicine (M.B.).

This amendment in the regulations has been made retroactive, so that every graduate in Medicine of the University of Toronto who now holds the degree of Bachelor of Medicine is entitled on application to be admitted without examination to the degree of Doctor of Medicine (M.D.) on the payment of a fee of Ten Dollars ($10.00).

Any graduate desirous of admission to the degree of Doctor of Medicine (M.D.) should forward his or her application with the fee of Ten Dollars, to the *Registrar of the University*, giving name in full, home address and year of graduation.

Graduates who have been admitted to the degree of Doctor of Medicine (M.D.) for post-graduate work are authorized to add the designation *cum laude* to the degree of M.D.

FOCAL INFECTION IN CHRONIC AND RECURRING DISEASES*

CHARLES H. MAYO,
Rochester, Minnesota

Members of the Faculty, Distinguished Guests, Fellow Students, Ladies and Gentlemen: I am very glad Dr. Balfour has instituted this lectureship because it gives me an opportunity of again coming to Toronto. The educational institutions of Toronto are well known the world over. Its University has made a great reputation for itself. As the city has grown it has provided a stimulus for the University to grow. The two have kept pace with each other. I think this is largely because so many citizens of Toronto have been educated in the University. This always increases civic culture, since men so trained elevate the race. There is something about living in Canada that is always apparent in those who have come from Canada. They never forget it and always speak of it as their home, no matter how many years ago they may have left it. Medical graduates of the University of Toronto are especially proud of their University. The University also has reason to be proud of them.

When medical progress apparently lags it is often due to neglect to honour the great physicians of the past, thus neglecting to call public attention to medical progress through those who have made great achievements. Such recognition stimulates present-day physicians to more thorough study and greater development. Continued study is necessary for the physician. Once you start studying medicine you never get through with it. If you are away from home for even a day or two some one discovers something new and you have to read it up and start over again. This is not so true of law. Law, for the most part, is a science of fixed premises, a science of the past, a science of precedent; medicine never becomes fixed, it never "sets".

I am most pleased to be with you to-day and to express my pleasure in being alive. I appreciate the privilege of having lived, as many of you have, during the last half century, which has been a period of accomplishment far greater than that of any other period in the world's history. It has been a culmination, as it were, of centuries of preparation.

In the last 100 years about 95 per cent. of all the science in the world has been developed and most of its practical application has been made during the last fifty years. More has been done to develop medicine in the last twenty-five years than in the previous twenty-five centuries.

The real progress of the world began when man discovered the use of power and means of controlling it. Power enables him to accomplish through a machine the work of several men by the effort of one man. Power enables man to travel fast and far. Travel for many centuries was slow and unsafe. Often those who desired to travel far awaited the accumulation of a group of sufficient size to provide greater safety.

*Balfour Lecture, University of Toronto, April 5, 1928;

In London, it is of interest to note the churches built at the gates leading out of the old city at which the traveller always stopped to pray for safe return. If he did return he gave liberally to the support of the church. Men thought of our earth as an enormous world 200 years ago. How relatively small it seems now as we are able to travel about or even around it by land, water, or air, at marvellous speed.

This apparent reduction in the size of our world through the use of power gives us immediate knowledge of our neighbours abroad and makes us interested in their lives and work. Electricity, radio and the movie have also contributed to the rapidity of the diffusion of knowledge throughout the world.

But this control of the earth has made it necessary for us to grow bigger men, men of judgment with sufficient intelligence to run machinery. Of course, there must always be men at the bottom, someone to dig in the ditch and to hew timber; but the bulk of us in the world to-day have got to learn to start the car, to steer it, and to stop it. As we take part in progress how seldom do we think how few men in the world have contributed to our knowledge of power which makes the accomplishments of to-day possible.

The three primal urges of man have ever been food, safety of life, and reproduction. Man, when a savage and when emerging into civilization, has always felt the urge which, as a rule, he has not resisted, to take from those who had if he could do so by cunning or might. Man is the greatest of fighting beasts because he has the greatest intelligence. We have still left on the earth groups of people representing every age of civilization. The recent discovery of certain aborigines in New Guinea who have no metal but are using the stone-age hammer and flint knives (although they do have in addition bows, arrows and spears) was a great event historically and gives us an insight into their primitive ways of life.

Early civilization probably began in the area between the Euphrates and Tigris rivers. There was the first development of agriculture and the beginnings of irrigation. Some tribes domesticated animals and sought the pastures and oases of the desert. Others planted and harvested, thus of necessity remaining in one area as farmers. This early civilization spread westward, north of the Arabian desert, to the Nile and there started another civilization.

In the earliest period medicine and religion developed together, the priest and the medical man being one. This may have been because neither job took all of one man's time. There wasn't much known about medicine. Medicine first began to be organized from the work of Esculapius, sometimes called the God of Medicine, many centuries before Christ. Hippocrates, the Father of Medicine, was born 460 B.C. In his voluminous case histories was found the record of a patient relieved of rheumatism by extracting a diseased tooth. Little appeared in literature concerning similar cases until Benjamin Rush reported another case almost like that of Hippocrates.

After Celsus and Galen, the great physicians of the first and second centuries, there was little progress for nearly 1000 years. Between the eighth and tenth centuries the greatest progress was made by the Moors

and Arabs. In the drawings and paintings of a few centuries ago people are often depicted as scratching themselves. Most of them were more or less covered with vermin. Their clothing, especially that of the men, was sewed on them. We see pictures of their tightly fitting coats and especially trousers, and wonder how they could get their feet through them. In England to-day judges in the courts still wear wigs. This is in honour of their early court days in the development of law. But wigs came into fashion that the hair could be cut short so that men could rid themselves of vermin. This was before the days of the fine-tooth comb. Pepys' Diary is interesting since it gives an accurate description of the way people lived only a few centuries ago in England. Pepys' description of the plague in London is better than that recorded in any medical work. When Pepys was about thirty-eight years of age he had to cease writing his diary because he could no longer see to write. His was probably a case of presbyopia. It reminds us of the comforts of our eye glasses which now relieve both near and far vision. Spectacles, however, are not of recent origin. About thirty years ago there was discovered at the site of Carthage a pair of spectacle frames without lenses. It is interesting also to note that in the excavation of Pompeii, in the remains of an apothecary shop, wonderfully delicate surgical instruments have been discovered for operations on the eye. Among them also was a trivalve speculum. With one movement of a pair of scissor-handles, three blades were opened. It was almost exactly like one invented, or rather reinvented, by a medical genius in 1900. With present-day development of print-paper the greater part of the world is one. We cannot conceive of such a regression of progress as that between the days of Carthage and those recorded by Pepys.

A redevelopment of optical instruments was begun by the building of the first microscope by the Janssen brothers in 1590. Galileo built telescopes in 1609. Tradition says that another man built a telescope the previous year, but communication was slow and the work of these two was unknown to each other. By better lens grinding Leeuwenhoek in 1683 made the microscope a great aid to human vision. Leeuwenhoek probably saw bacteria with his microscope. At least some of his drawings of microscopic objects seem to represent bacteria. But the marvels of the new world of microscopic life were not appreciated until Pasteur wrote his observations on fermentation in 1857. He was a broadcaster of the knowledge of the world of microscopic life. We now know that multicellular organisms could not have developed without the aid of single-celled organisms. It was Pasteur's studies on fermentation that started Lister to France to study with Pasteur. It was not, however, the bacteria in fermentation that interested Lister, but the relationships of other bacteria to disease, gangrene, and so forth.

Following Pasteur, the discovery of the specific bacteria of disease went on rapidly by the microbe hunters. Many acute diseases which had been observed to cause definite symptoms were each found to have a specific microbe. Public health, through our knowledge of bacteria, has become possible and preventive medicine has reduced the dangers of community life by control of food and water supplies and by the segregation of patients with contagious diseases. We have begun to appreciate

that man has been destroyed in the past, as now, by his own filth. The average age of man in the sixteenth century was twenty years; in 1850 it was forty years; in the next twenty-five years only five years more were added to the length of life. Now it has advanced to fifty-eight years. Much of this has come about by the saving of children, especially babies.

This increased length of life, however, has brought on new problems to be dealt with. If man lives longer how may he avoid senility? The problems of the cell degeneration of age must be attacked particularly. This includes cancer, which has naturally increased as man has come to live longer. The good and the bad both live longer through better care and the prevention of disease. Morons and other mentally defective individuals, many of whom in the past would have died young, are now enabled to live and to breed future generations. In the last thirty years insanity has more than doubled. The mentally defective can no longer be crowded into the available institutions for the feeble-minded. The average juryman hesitates to take action to inhibit the reproductive ability of morons and others mentally defective. We should somehow rearrange our educational system and our legal policies to conform with the greater knowledge which has now accumulated.

The work of Lister, whose hundredth anniversary was celebrated last year, marks one of the great epochs in medicine. Lister learned of Pasteur's work and observed it in fermentation. He immediately saw the application to surgery of this new principle of the relationships of minute life to disease. His work in preventing infection in wounds and injuries made surgery possible. Through the vision of Lister was developed antiseptic surgery which later, aided by other investigators in many countries, was advanced to aseptic surgery. Every cavity of the body and every structure therein has been reached by the surgeon in an effort to ameliorate suffering. All of this has been developed from Lister's work.

Besides forming the basis of modern surgery, the work of Pasteur and Lister has given us a sure footing in the study of disease generally. Individual diseases and their complications have been observed in all stages. We have thus come to appreciate the associated diseases of the body and have often found that they arise from a single causative agent. Man having been protected against his great destroying pests of the past has now come to have the privilege of dying of his individual troubles. Those diseases which caused the death of his ancestors still predominate, but by greater care he may change his inheritance for the better; by neglect and excess for the worse.

It has been estimated that, eliminating accidental destruction, 86.5 per cent. of all human mortality is due to acute or chronic infections. There is nothing more instructive or interesting for the physician to witness than a careful necropsy made by a trained pathologist. The past life of the individual is revealed in the complications clustered around the eventual cause of death. Such examinations create the impression that there are few people, fifty or more years of age, who are entirely well regardless of how they may feel. The scars of old and new infections in the heart, kidney, liver, pancreas, and spleen are common. Changes

in the lungs from tuberculosis, either healed or in subacute conditions, and acute or chronic pleural infections, are all to be seen. From 8 to 12 per cent. of all individuals show the lesions of syphilis. Unsuspected cancer is often found involving one or more of the internal organs. Fortunately nature has endowed us liberally with the essential structures of the body. The loss of one of the duplicate organs, as the kidney, eye or ear, is apparently withstood with little inconvenience to the individual, although his reserve resistance to disease may be somewhat reduced.

Fortunately a few men have devoted their whole professional lives to a study of infectious diseases. The acute contagions are studied by those engaged in public health work. Others are interested in the chronic or recurring diseases. Recurring diseases in which the symptoms are similar are frequently found to be caused by a local focus of infection. But few investigators have developed great skill in locating foci and experimental reproduction in animals of recurring infectious diseases. These medical investigators usually work as members of groups, since all departments of medicine must look to them for aid. Any disease which recurs with like symptoms, whether it be of the eye, ear, skin, nerves, lungs, joints, muscles, or other parts, should be investigated to determine if it is not the result of focal infection. A few years ago the teeth were blamed for most focal infection and were unnecessarily sacrificed without sufficiently careful or extensive investigation. Rich diets and the cooking of food in modern life contribute to the loss of the teeth by decay. Twenty-five per cent. of our school children are found to have teeth that should be extracted. More than 50 per cent. of them need fillings to preserve their teeth. It is then very important that the school systems of our larger cities, and, if possible, of our smaller cities also, should provide for part or whole-time dentists in connection with their health departments. If we do not make use of modern health protection the children of foreign-born parents will not be improved in health as future citizens. At present many of them, when they begin their education, are already on the way to poor health.

Crowning of nerve-killed teeth makes it only a question of time when a painless periapical abscess will form and become a possible source of infection of some other portion of the body. In structures secondarily infected the injury is often unsuspected until it is discovered when too late to be repaired, as in myocardial disease.

Tonsils usually become infected with the same organism as in pyorrhea (Rigg's disease of the gums). Tonsils are usually classified pathologically on the basis of the size which is graded 1 to 4; these grades may also be used to indicate the degree of infection. In children the tonsils become inflamed from time to time and form the focus for valvular heart disease, which may remain during the lifetime of the individual. Vegetations on the heart valves of adults, if acute and primary, are even worse than in children, and usually develop into a form of fatal infection with death from pyemia, a condition of malignant endocarditis. Tonsils in adults, which in size are graded only 1 or 2, are dangerous tonsils if they are infected. Associated with types of disease which recur, such tonsils are always under suspicion and should be removed and examined

bacteriologically. Tonsils of grades 3 and 4 in size are large because they are still maintaining local combat with an infecting organism. Later such tonsils also become possible foci for infection at distant points.

In the eye recurring disease of the choroid, retina, iris, and cornea is probably more often from infection of the cervix in women and from infection of the prostate in men than from infections of the mouth.

Rheumatism of the smaller joints associated with Heberden's nodes on the finger joints is more common in women than in men. Possible foci of infection should be investigated. If the cervix is infected it may be removed. It may be necessary, or at least best, to remove the entire uterus. As a rule rheumatism of the smaller joints in women begin at from forty to forty-two years of age. The treatment suggested is advisable as late as the age of sixty. It is the virulence of the streptococci and not the size of the area which they infect that determines the amount of injury.

Intercostal neuralgia and pain in the area of the nerves of the eleventh and twelfth ribs which is too constant to be of internal origin are often cured by well-directed efforts for the relief of oral infection. Shingles is simply a term describing intercostal neuralgia with herpes.

Stone in the bladder has several etiologic factors. The reproduction of the same types of stone as are found in man may often be experimentally produced in the kidneys of animals by devitalizing the animal's large bicuspid teeth, using the most careful technic of asepsis, and then by packing the pulp area and root cavity with bacteria centrifuged from the urine of persons with stones in their kidneys. The teeth are then crowned, and in from two and a half to three months apical abscesses develop. After from seven to ten months, as a rule, one or both kidneys show stone formation. About 66 per cent. of such experiments are successful in that there is development of renal stones similar to those found in man. In about 20 per cent. of the experiments the medullary area of the kidneys will be found infiltrated with calcium.

There is not much crystalline calcium in the world. The more pure the calcium the more surely it has been handled by bacteria or other living cells. We may read the Pre-Cambrian history of the world in the calcium mud and fossilized remains of the early types of animal life. We may compare the bacteria which build the different types of stone in the kidney to brick masons, terra cotta workers, cement builders and stone masons. These emphasize the necessity in dealing with stone in the kidney of removing also all possible foci of infection. If not removed these foci may cause the development of other stones in the kidney after the first have been removed.

I want to close with just one other point. Medicine is about as big or as little in any community, large or small, as the physicians make it. If you go into a city and find all kinds of advertising signs of every type of cult you may be sure that the cultists are doing a better job of talking to the people than are the members of the medical profession. A person who is sick wants assurance; the cultist assures him that he will be cured. We have a great number of pessimists in the medical profession. You would think the undertaker was right behind them, everything is

so sad and serious. They get along because they are never surprised at the arrival of hard luck and they always keep the family in an appreciative attitude. But it is unfortunate that these men should be members of the profession.

In some places the cults have almost been eliminated. There is an organized medical profession, the members of which meet and not only help each other, but secure speakers from outside their community to come in and address them. Such talks may be made of great value to the public generally, especially if they concern public health and the diseases that may be avoided.

COURSES FOR GRADUATES IN MEDICINE

The Faculty of Medicine of the University of Toronto recognizes that the practitioners of the Province are anxious to keep closely in touch with the advances in Medicine, and that they have a claim on the Provincial University to aid them in doing so. The Faculty considers this entails on it a duty second only to the instruction of the undergraduate.

At the present time the large amount of undergraduate teaching makes it impossible to offer during the academic session set courses of sufficient variety to meet all the needs of those who seek further study.

Those who have studied abroad know that the routine method is for the graduate to attend the instruction given to the students of the senior years in Medicine, to follow the ward rounds and to go to the out-patient department picking up what he can. The Faculty has opened the courses of instruction given to the higher years in Medicine to any one who cares to attend and refresh his knowledge in this way. A Standing Committee has been appointed whose duty it is to give any graduate interested advice as to the clinics and lectures which should be taken, and to confer with the heads of departments and individual teachers so as to arrange a course in advance for each applicant. Such a course may be modified by the committee if it does not prove suitable.

During each year graduates attend undergraduate courses of this kind.

All the library facilities of the University will be open to any post-graduate student under the usual conditions.

The staff fully realizes that every effort must be made to render the visit of each post-graduate student both pleasant and of real value. Instruction may be obtained as outlined above in the following:

Medicine.
Surgery.
Obstetrics and Gynaecology.
Paediatrics.
Otology, Rhinology, Laryngology.
Ophthalmology.
Preventive Medicine.
Pathology and Bacteriology.

The University will impose a minimum fee of $25.00 per month. This will be imposed for any course of less than a month as a registration fee. Graduates attending courses will be charged a supply fee to cover the cost of materials or equipment supplied.

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